



digital

LA120-RA

USER GUIDE

digital

LA120-RA

USER GUIDE

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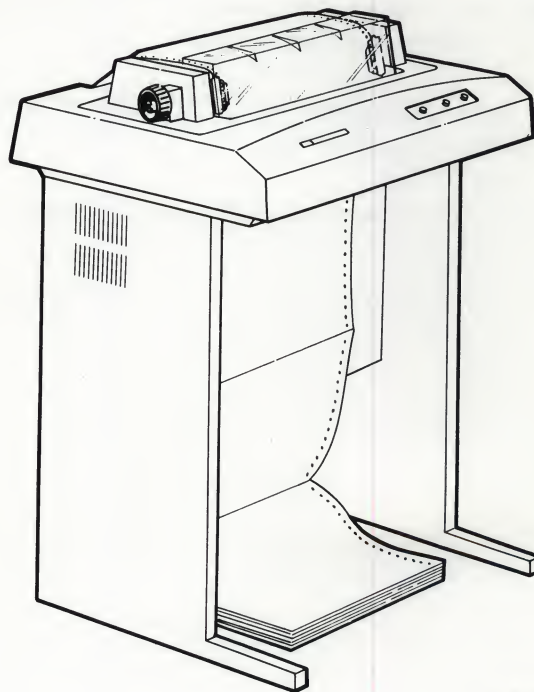
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APPENDIX A

INTRODUCTION

The LA120-RA is a high-performance, pedestal-mounted, receive-only, hard-copy printer. It is capable of bidirectional printing at a rate of up to 180 characters per second. The LA120-RA offers easy to use communication features that allow a user to tailor the printer to suit specific application needs.

The LA120-RA is compatible with both EIA standard RS-232-C and ANSI standards 3.4 and 3.41. In addition to the standard features built into the LA120-RA, there are a number of options and accessories that may be added to the printer to provide a user with a wider range of applications.



MA-4708

The LA120-RA User Guide is organized as follows.

- Chapter 1 Operating Information
- Chapter 2 Programming Information
- Chapter 3 Communication Information
- Chapter 4 Installation, Interface Information, and Specifications
- Chapter 5 Option Information
- Chapter 6 Supplies and Accessories

Chapter 1 introduces the operator to the LA120-RA controls, indicators, SET-UP mode and SET-UP features. Chapter 1 also provides the procedures required to change ribbons, to load forms and to adjust the print impression. An operator troubleshooting section provides the operator with the necessary information to service minor printer problems.

Chapter 2 discusses the implementation of control functions using control characters, escape sequences, control sequences and control strings. Methods used to regulate data to the input buffer are also provided.

Chapter 3 contains detailed information concerning modem control protocols, and the function and timing of EIA RS-232-C signals.

Chapter 4 describes how to unpack, pack, and install the LA120-RA. Printer specifications are provided to the end of the chapter.

Chapter 5 provides option information for the 20 mA loop option, the expanded buffer option, and optional character sets.

Chapter 6 lists the supplies, accessories, and related documents that are available for the LA120-RA.

CHAPTER 1

OPERATING INFORMATION

GENERAL

Chapter 1 contains information required to operate the LA120-RA. Chapter 1 is organized as follows.

- Part 1 Printer Operation
- Part 2 Controls and Indicators
- Part 3 SET-UP Features
- Part 4 Ribbons, Forms and Print Impression
- Part 5 What To Do Before Requesting Service

PART 1 PRINTER OPERATION

When the LA120-RA is on-line, the printer can receive data from a remote device (i.e., host computer).

The LA120-RA can also be temporarily switched off-line by generating a pause request to the remote device. This pause request signals the remote device to stop sending data to the printer. While off-line, the operator may use the local form feed and self-test features, or open the top cover, to select or change SET-UP features. SET-UP features are fully described in Part 3 of this chapter.

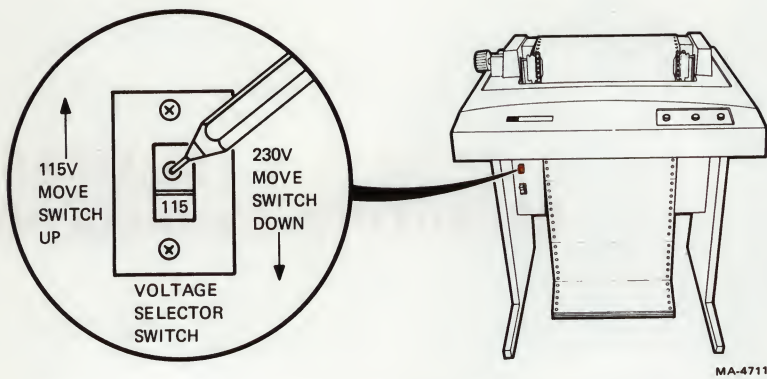


Figure 1-1 Voltage Selector Switch

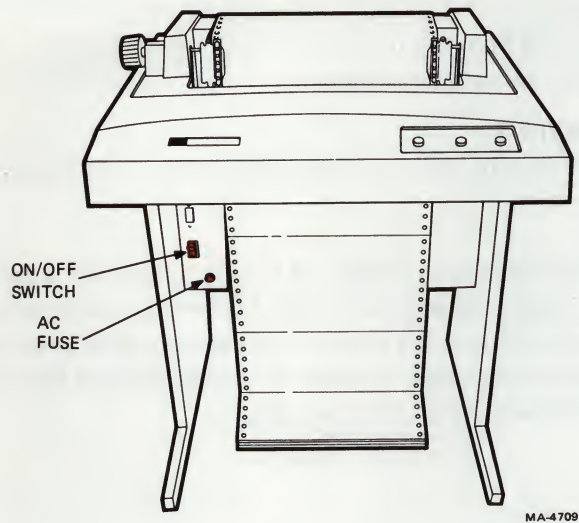


Figure 1-2 ON/OFF Switch

PART 2 CONTROLS AND INDICATORS

PRINTER CONTROLS

The following paragraphs describe the function of the printer controls.

Voltage Selector Switch

This switch allows the operator to select a 115 Vac or 220 Vac voltage setting (Figure 1-1).

CAUTION: Failure to set the switch to 220 V when plugging the LA120-RA into the 180 – 256 V power source will result in damage to the power supply. (See the *Installation, Interface Information, and Specifications Chapter* for more detail.)

ON/OFF Switch

This switch turns power to the LA120-RA on or off (Figure 1-2).

NOTE: A step-by-step power on procedure is provided in the *Installation, Interface Information, and Specifications Chapter* and should be read before using this switch.

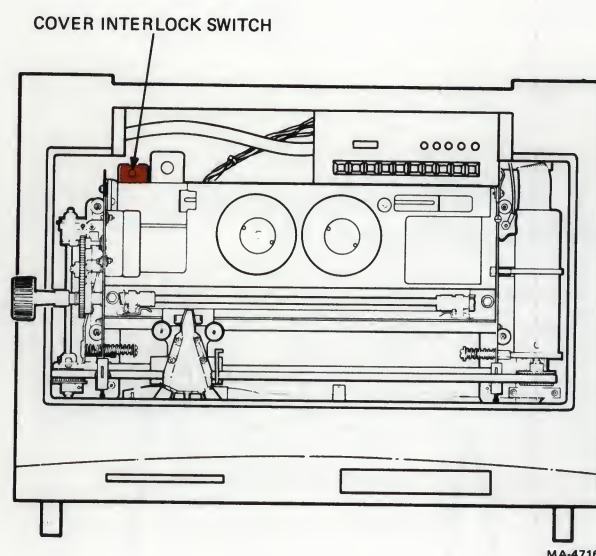


Figure 1-3 Cover Interlock Switch

Cover Interlock Switch

This switch is a feature that stops all printer operation when the top cover is opened (Figure 1-3). With the top cover opened, the cover interlock switch will allow a paper out or printhead jam condition to be serviced, and SET-UP features to be changed or altered. When the top cover is closed, printing automatically resumes.

Paper Advance Knob

This knob advances the paper 1/12 of an inch at a time (Figure 1-4). Press in and turn the paper advance knob to roll the paper freely in either direction. This allows the operator to vertically position forms. The paper advance knob should only be used when first positioning a form. (See Part 3 of this chapter.) After first setting up a form, advance the paper using the LOCAL FORM FEED switch.

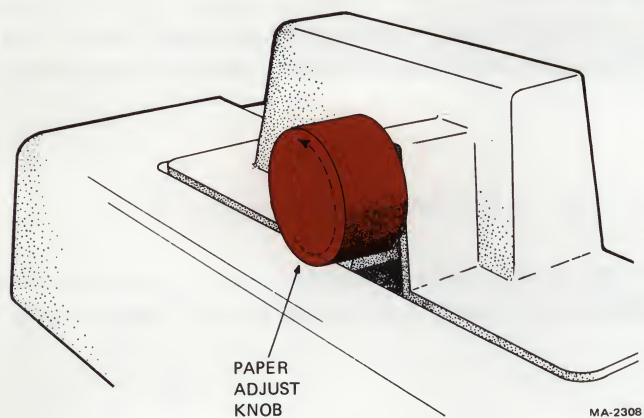


Figure 1-4 Paper Advance Knob

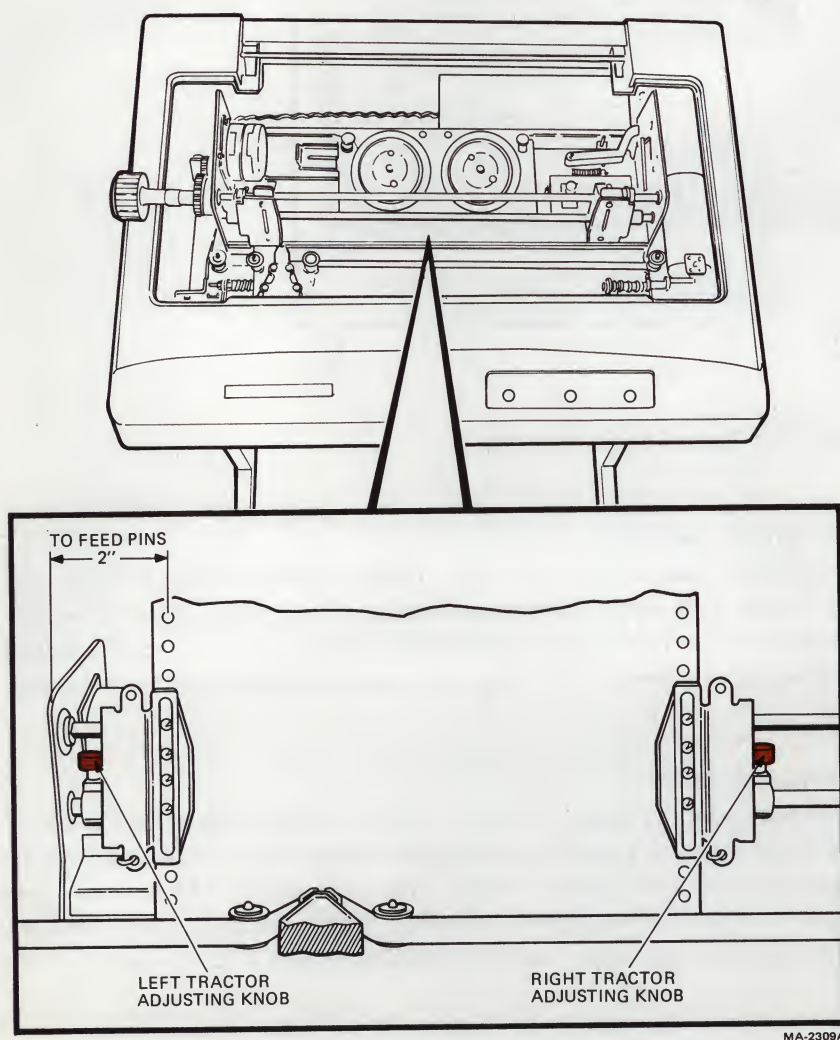
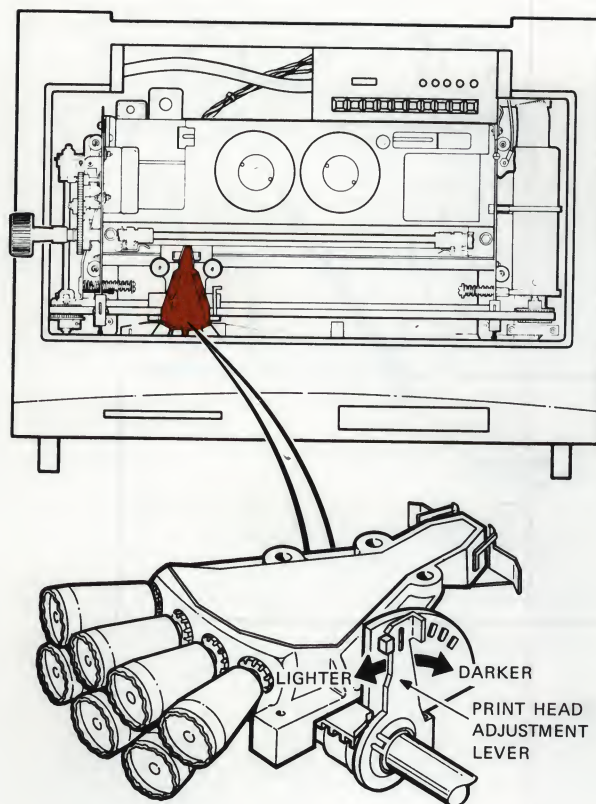


Figure 1-5 Tractor Adjust Knobs
(Top View)



MA-4712

Figure 1-6 Printhead Adjustment Lever
(Top View)

Tractor Adjust Knobs

These knobs allow the operator to horizontally position forms (Figure 1-5). (See Part 3 of this chapter for more detail.)

Printhead Adjustment Lever

This lever controls the space between the printhead and the form. This allows the operator to adjust for single or multipart forms (Figure 1-6).

OPERATOR'S CONSOLE

The operator's console (Figure 1-7) is used to provide the operator with easy access to the commonly used local form feed and self test features. The following paragraphs describe the functions of the operator's console.

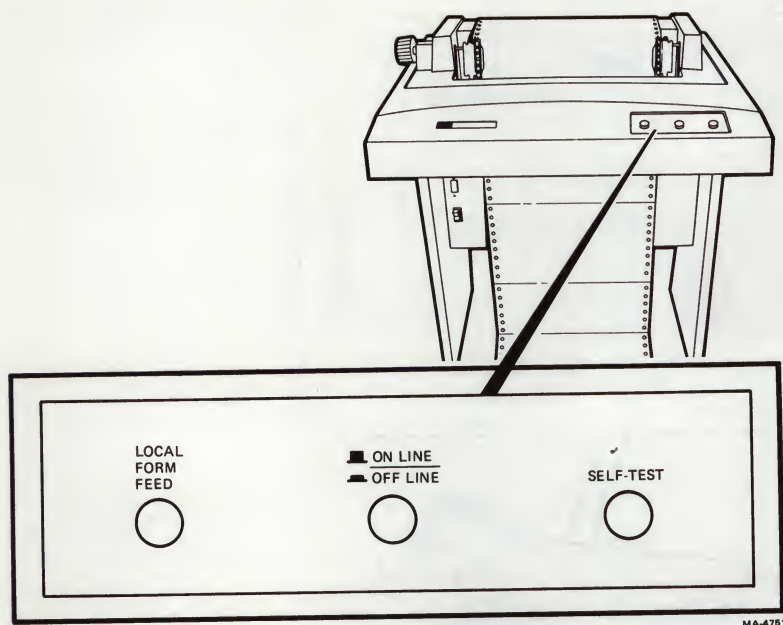


Figure 1-7 Operator's Console

ON LINE/OFF LINE

When power to the LA120-RA is turned ON, the printer will be in the on-line mode. When the ON LINE/OFF LINE button is pressed (and as long as it is pressed), the LA120-RA will transfer to off-line mode.

NOTE: When applying power to the LA120-RA with the ON LINE/OFF LINE button pressed, the printer will recall factory stored settings (see the Factory Stored Settings section in this chapter).

LOCAL FORM FEED

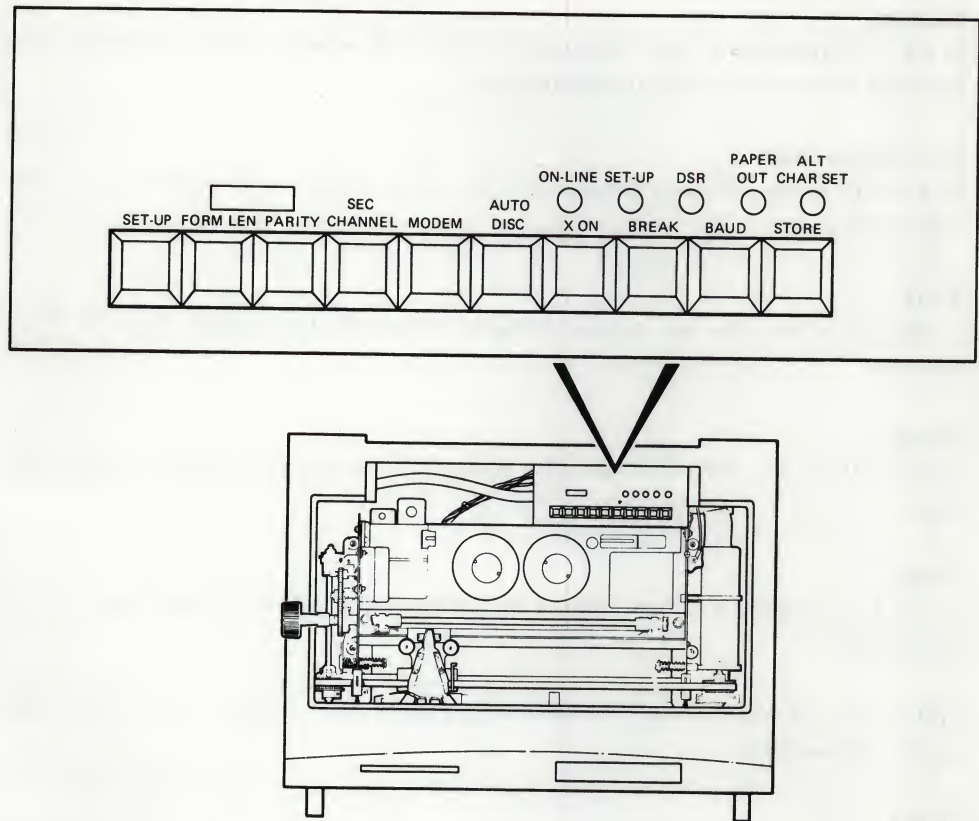
When the LA120-RA is off-line and this button is pressed and released, the paper will advance to the top of the next form. Once the form feed begins, the ON LINE/OFF LINE button may be released to put the LA120-RA in the on-line mode.

SELF-TEST

This feature verifies proper operation of the LA120-RA. The self test prints a pattern of characters within the currently selected margins. When the LA120-RA is off-line, press and release the SELF-TEST button to begin the self test. The ON LINE/OFF LINE button may then be released. Press the SELF-TEST button again to stop the self-test and return the LA120-RA to the on-line mode.

SET-UP CONTROL PANEL

Figure 1-8 shows the SET-UP control panel keys. These keys function only in SET-UP mode. The following paragraphs briefly describe the function of each key when in SET-UP mode. A detailed description of SET-UP mode is provided later in this chapter and should be read before using these keys.



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Figure 1-8 SET-UP Control Panel
(Top View)

SET-UP

This key is used to enter or exit SET-UP mode. To enter SET-UP mode press and hold the SET-UP key. Continue to press the SET-UP key while changing a SET-UP feature.

WARNING: Keep hands and loose objects away from printhead as the LA120-RA may resume printing (up to two lines) when the top cover is opened and the SET-UP key is pressed.

Forms Length

In SET-UP mode, this key sets the number of lines per form.

Parity

In SET-UP mode, this key enables or disables parity and allows the selection of seven or eight data bits.

Secondary Channel

In SET-UP mode, this key allows the operator to select speed control or restraint mode in full-duplex modem protocols. In half-duplex modem protocols this feature allows the use of secondary channel.

Modem

In SET-UP mode, this key allows the operator to select a modem protocol that matches the communication requirements.

Auto Disconnect

In SET-UP mode, this key allows the operator to enable or disable the auto disconnect feature.

XON

In SET-UP mode, this key allows the operator to select or disable the XON/XOFF feature.

Break

In SET-UP mode, this key allows the operator to enable or disable the break feature.

Baud

In SET-UP mode, this key selects the receive and transmit baud rates of the LA120-RA.

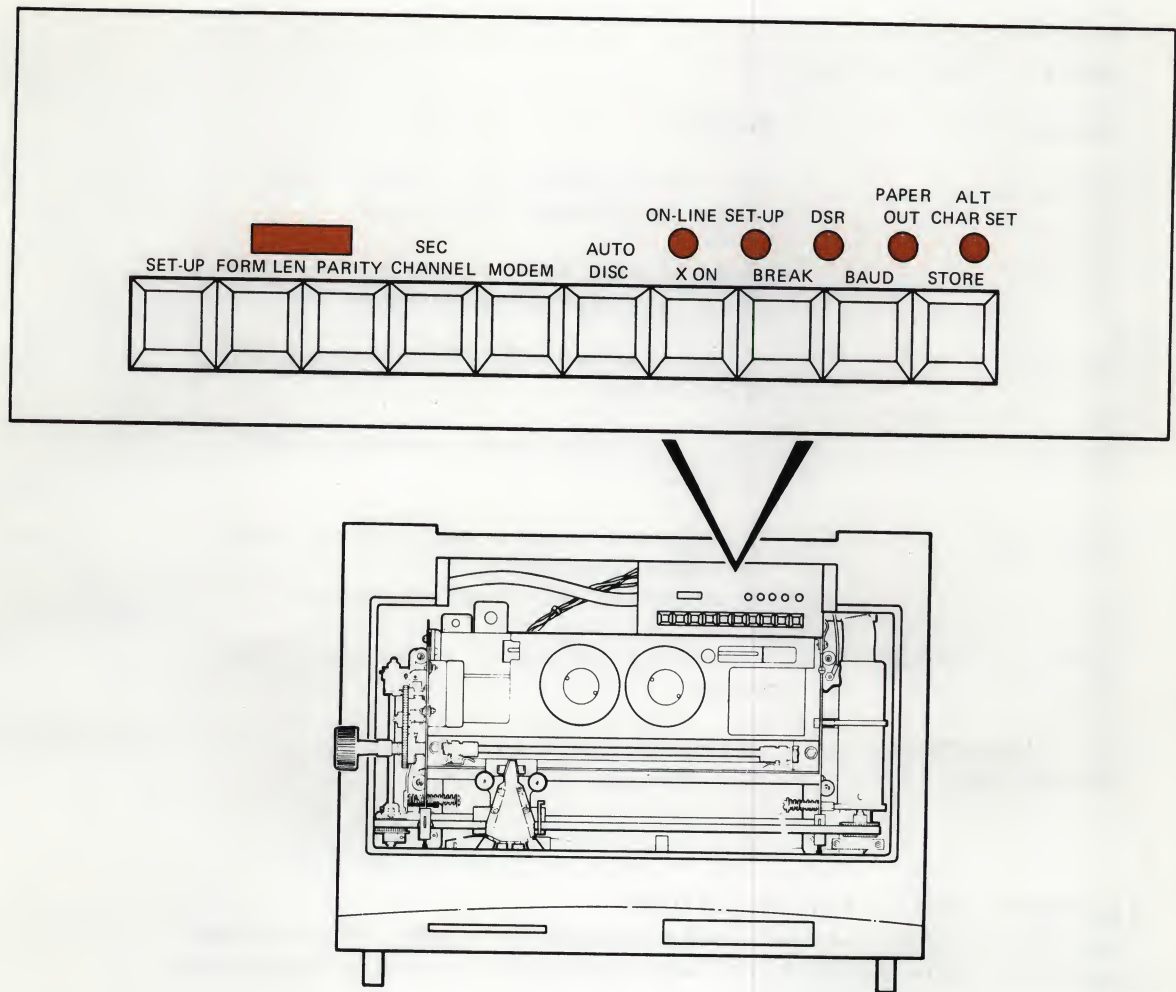
NOTE: The LA120-RA has the ability to transmit XON and XOFF (DC1 and DC3) control characters.

Store

In SET-UP mode, this key causes all SET-UP features in temporary memory to be stored in a permanent memory.

VISUAL INDICATORS

Figure 1-9 identifies the visual indicators of the LA120-RA. Table 1-1 describes each indicator in detail.



MA-4714

Figure 1-9 Visual Indicators

Table 1-1 Visual Indicators

Indicator	Function
Numeric display	When the LA120-RA is not in SET-UP mode, indicates the next column to be printed In SET-UP mode, indicates the current status of the SET-UP feature being selected (Figure 1-9)
ON-LINE	Indicates that the LA120-RA is on-line and ready to receive data
SET-UP	Flashes to indicate that the LA120-RA is in SET-UP mode
PAPER OUT	This light is on during a paper out condition. The light flashes when the LA120-RA is not ready, due to a cover open or printhead jam condition
DSR (Data Set Ready)	Indicates that the modem is in data mode (data set ready)
ALT CHAR SET (Alternate Character Set)	Indicates that an optional character set, such as APL, is in use

BELL TONE AND ALARM INDICATORS

The LA120-RA produces a low pitched alarm signal and a high pitched bell signal. The operator should become familiar with the conditions that cause these signals to determine the correct response.

Bell Tone and Continuous PAPER OUT Light

Cause	Action/Comments
-------	-----------------

Paper out	Load paper (see the Ribbons, Forms, and Print Impression section). Printer will resume normal operation after paper is loaded and the top cover is closed.
-----------	--

Bell Tone and Flashing PAPER OUT Light

Cause	Action/Comments
-------	-----------------

Printhead jam	Open top cover and clear obstruction causing printhead jam (see Operator Troubleshooting section). Reload paper by aligning perforation with printhead line indicator (see Operator Troubleshooting section, Part 4 of this chapter). Close cover.
---------------	--

Cover open	Close top cover.
------------	------------------

Bell Tone Only

Cause	Action/Comments
-------	-----------------

Bell character	Each bell character code received causes a bell tone.
----------------	---

Alarm Tone Only

Cause	Action/Comments
-------	-----------------

Input buffer overflow	Sub character is placed in data stream where overflow occurs.
-----------------------	---

PART 3 SET-UP FEATURES

SET-UP MODE

The LA120-RA is equipped with 9 built-in SET-UP features. Each feature is designed to provide compatibility to a computer system or modem. The operator may select, alter, and store SET-UP features only while the LA120-RA is in SET-UP mode. SET-UP mode may be used while the LA120-RA is off-line. However, to prevent data loss while on-line, SET-UP mode should only be entered while the remote device is not sending data. If your system supports XON/XOFF, or the restraint signal, data loss is prevented.

Perform the following procedure to enter and exit SET-UP mode.

WARNING: Keep hands and loose objects away from printhead as the LA120-RA may resume printing (up to two lines) after the top cover is opened and the SET-UP key is pressed.

Procedure	Comments/Indication
Press ON LINE/OFF LINE button.	Wait for printing or paper feed to stop.
Open top cover.	Paper out light flashes to indicate top cover is open.
Release ON LINE/OFF LINE button. Press and hold the SET-UP key.	SET-UP light flashes indicating that the LA120-RA is in SET-UP mode. The ON-LINE light goes off.
The operator may now examine or change SET-UP features.	The numeric display will display information pertaining to the SET-UP feature being selected.
Release the SET-UP key to exit SET-UP mode.	The SET-UP light stops flashing and the ON-LINE lights goes on.
<p><i>NOTE: SET-UP features that have been changed are stored in temporary memory. See the Store feature description to save SET-UP features in permanent memory.</i></p>	

SET-UP FEATURES

To receive data, the LA120-RA must be compatible with the hardware and software of the remote device. Therefore, once the SET-UP features are selected they should not be changed unless compatibility is verified. The following are SET-UP features.

Forms Length	XON
Parity	Break
Modem	Baud
Secondary Channel	Store
Auto Disconnect	

Forms Length

The LA120-RA measures form length in lines per form. To determine form length, measure the length of the form in inches, then multiply the length of the form by the lines per inch currently selected. Table 1-2 shows the lines per form available using the given form length and lines per inch.

Table 1-2 Form Length (Lines Per Form)

Form Length in Inches	Lines per Inch Selected					
	2	3	4	6	8	12
3	6	9	12	18	24	36
3.5	7	*	14	21	28	42
4	8	12	16	24	32	48
5.5	11	*	22	33	44	66
6	12	18	24	36	48	72
7	14	21	28	42	56	84
8	16	24	32	48	64	96
8.5	17	*	34	51	68	102
11	22	33	44	66†	88	132
12	24	36	48	72	96	144
14	28	42	56	84	112	168

* Not recommended

† 11 inch form at 6 lines per inch = 66 line form length.

Perform the following procedure to enter the number of lines per form. The operator can select a form length ranging from 1 to 168 lines.

NOTE: Changing form length sets the current line number to 1.

Procedure	Comments/Indication
Measure the form length in inches.	
Perform the self test procedure (See Part 5 of this Chapter for self test).	
Using a standard 12 inch ruler, count the printed lines per inch on your form (as shown in Figure 1-10).	
<i>NOTE: A sample of each lines per inch selection is shown in Figure 1-11.</i>	
Multiply the length of the form in inches by the selected number of lines per inch to get lines per form.	
Enter SET-UP mode.	SET-UP light flashes indicating the LA120-RA is in SET-UP mode and the ON-LINE light goes off.
Press FORM LEN .	Current form length in lines per form is displayed in the numeric display.
Continue to press FORM LEN to change lines per form.	Numeric display will indicate a new value each time the FORM LEN key is pressed. Stop when the desired number of lines is displayed.
Exit SET-UP mode.	SET-UP light stops flashing and the ON-LINE light goes on.

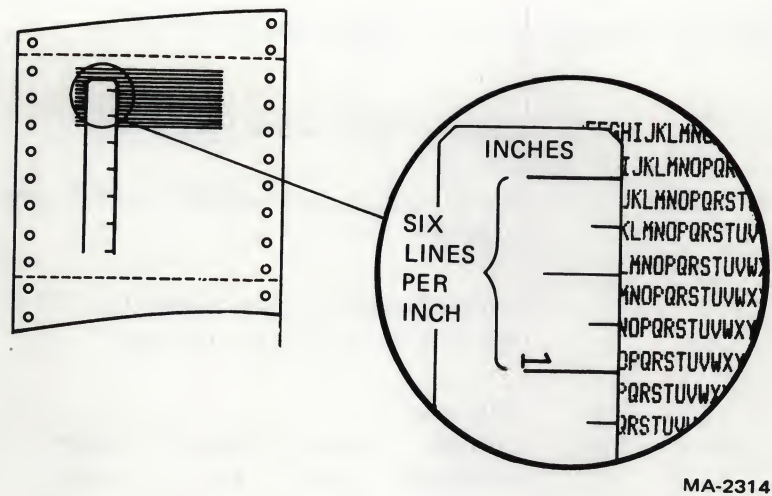



Figure 1-10 Selecting Lines Per Inch

2	3	4	6	8	12
!	!	!	!	!	!
"	"	"	"	"	"
£	£	£	£	£	£
\$	\$	\$	\$	\$	\$
%	%	%	%	%	%
&	&	&	&	&	&
'	'	'	'	'	'
((((((
*)	*)	*)	*)	*)	*)
+	+	+	+	+	+
-	-	-	-	-	-
.

Figure 1-11 Lines Per Inch Example

Parity

With this feature enabled, data errors are monitored and the transmission of data is verified. If the parity feature is enabled and an error in transmission occurs, the LA120-RA detects it and indicates the error by printing a SUB character  symbol for each incorrect character.

In addition to parity, this feature allows the operator to select seven or eight data bits per character.

Perform the following procedure to select or change the parity feature.

Procedure	Comments/Indication			
Enter SET-UP mode.	SET-UP light flashes and the ON-LINE light goes off.			
Press PARITY	Current selection of parity and data bits is displayed in the numeric display.			
Press PARITY again to change the parity and data bit selection.	Numeric Display Indicates	Data Bits	Parity Rec	Parity Xmit
	1	7	Ignore	Mark
	2	7	Ignore	Space
	3	7	Ignore	Odd
	4	7	Ignore	Even
	5	7	Odd	Odd
	6	7	Even	Even
	7	7	None	None
	8	8	None	None
	9	8	Odd	Odd
	10	8	Even	Even
Exit SET-UP mode.	SET-UP light stops flashing and the ON-LINE light goes on.			

Modem

This feature enables the selection of a modem protocol that matches your communication requirements. (See Communication Information chapter for detailed information.)

The following are selectable modem protocols.

- Full-duplex without EIA control (no modem)
- Full-duplex with EIA control (modem)
- Half-duplex with supervisory control
- Half-duplex with coded control (EOT turnaround)
- Half-duplex with coded control (ETX turnaround)

NOTE: Caution should be used when operating the LA120-RA with modem selection 4 or 5, as the printer operator cannot generate a turnaround character. (See Communication Information chapter for more detail.)

Perform the following procedure to select or change the modem setting of the LA120-RA.

Procedure	Comments/Indication												
Enter SET-UP mode.	SET-UP light flashes and the ON-LINE light goes off.												
Press MODEM .	Current selection of modem is displayed in the numeric display.												
Press MODEM again to change selection.	<table> <tr> <th>Numeric Display Indicates</th><th>Description</th></tr> <tr> <td>1</td><td>FDX, No Modem</td></tr> <tr> <td>2</td><td>FDX, Modem</td></tr> <tr> <td>3</td><td>HDX, Supervisory</td></tr> <tr> <td>4</td><td>HDX, EOT</td></tr> <tr> <td>5</td><td>HDX, ETX</td></tr> </table>	Numeric Display Indicates	Description	1	FDX, No Modem	2	FDX, Modem	3	HDX, Supervisory	4	HDX, EOT	5	HDX, ETX
Numeric Display Indicates	Description												
1	FDX, No Modem												
2	FDX, Modem												
3	HDX, Supervisory												
4	HDX, EOT												
5	HDX, ETX												
Exit SET-UP mode.	SET-UP light stops flashing and the ON-LINE light goes on.												

Secondary Channel

This feature has a different meaning depending on which modem choice is selected. If modem choices 1, or 2, or 3 have been selected, the secondary channel feature selects either restraint mode or speed control mode. (See Communication Information chapter for detailed information concerning restraint mode and speed control mode.)

Perform the following procedure to select or change the secondary channel feature.

Procedure	Comments/Indication		
Enter SET-UP mode.	SET-UP light flashes, and ON-LINE light goes off.		
Press SEC CHAN .	Current selection of SEC CHAN is displayed in the numeric display.		
Press SEC CHAN again to change selection.	Numeric Display Indicates	Modem 1, 2, or 3 Selected	Modem 4 or 5 Selected
	0	Speed Control	Secondary Channel-Disabled
	1	Restraint	Secondary Channel-Enabled
Exit SET-UP mode.	SET-UP light stops flashing and the ON-LINE light goes on.		

Auto Disconnect

This feature is used in conjunction with full-duplex modem feature 2 and half-duplex modem features 3, 4, and 5. With Auto Disconnect selected, modem control features 3, 4, and 5 will hang up the phone line when the LA120-RA runs out of paper, the cover opens, or the printhead jams. This feature is especially useful if the LA120-RA is unattended. (See the Communication Information chapter for information regarding modem features.)

NOTE: If the auto disconnect feature is not used it must be set to off.

When auto disconnect is off, the EIA signal data terminal ready (DTR) is always asserted. When an error condition occurs and auto disconnect is enabled, the DTR signal is off and the remainder of the input buffer is cleared. (For related information refer to the XON and Break SET-UP feature). Perform the following procedure to select or disable the auto disconnect feature.

Procedure	Comments/Indication
Enter SET-UP mode.	SET-UP light flashes and the ON-LINE light goes off.
Press AUTO DISC .	Current selection of AUTO DISC is displayed in the numeric display.
Press AUTO DISC again.	Numeric display indicates one of the following: 0 = off 1 = on.
Exit SET-UP mode.	SET-UP light stops flashing and the ON-LINE light goes on

XON

The LA120-RA is capable of automatically generating the XON (DC1) and XOFF (DC3) control characters. When the remote device uses this method of buffer control, the XOFF control character should stop the transmission of data from the remote device to the LA120-RA. The XON control character requests the continued transmission of data. The XON SET-UP feature enables the LA120-RA to generate XON when:

- Transmit is enabled after power up,
- SET-UP mode is exited,
- The top cover is closed,
- The LA120-RA is on-line and the input buffer contains less than 256 characters.

The LA120-RA generates XOFF when:

- The LA120-RA is set to off-line,
- In SET-UP mode,
- An error condition (paper out, cover open or printhead jam) exists,
- The input buffer contains more than 576 characters.

NOTE: For the XON SET-UP feature to operate the software of the remote device must recognize XON.

Perform the following procedure to enable or disable the XON feature.

Procedure	Comments/Indication
Enter SET-UP mode.	SET-UP light flashes and the ON-LINE light goes off.
Press XON .	Current selection of XON is displayed in the numeric display.
Press XON again to change selection.	Numeric display indicates either: 0 = off 1 = on.
Exit SET-UP mode.	SET-UP light stops flashing and the ON-LINE light goes on.

Break

Selecting this feature causes the printer to automatically send a break signal in response to a paper out, cover open, or printhead jam condition.

If the modem system is set up to recognize break, sending a break signal may cause the phone to hang up. The phone can also be hung up if auto disconnect is enabled. (See the auto disconnect feature in this chapter.) With break disabled, a paper out, cover open, or printhead jam condition will not generate a break signal.

Perform the following procedure to enable or disable the Break feature.

Procedure	Comments/Indication
Enter SET-UP mode.	SET-UP light flashes and the ON-LINE light goes off.
Press BREAK .	Current selection of break feature is displayed in the numeric display.
Press BREAK again to change selection.	Numeric display indicates either: 0 = off 1 = on.
Exit SET-UP mode.	SET-UP light stops flashing and the ON-LINE light goes on.

Baud

Baud rate is the speed (bits per second) at which characters are received or transmitted by the LA120-RA. Due to the many systems the LA120-RA may communicate with, a large selection of baud rates are available.

NOTE: The LA120-RA has the ability to transmit the XON and XOFF (DC1 and DC3) control characters.

Perform the following procedure to select the receive baud rates of the LA120-RA.

Procedure	Comments/Indication		
Enter SET-UP mode.	SET-UP light flashes to indicate the LA120-RA is in SET-UP mode and the ON-LINE light goes off.		
Press BAUD .	Current selection of baud rate is displayed.		
Continue pressing the BAUD key to select the receive and transmit baud rate as indicated by the numeric display.	Displayed Baud Rate	Actual Baud Rate	Stop Bits
	50	50	2
	75	75	2
	110	110	2
	134	134.5	1
	150	150	1
	200	200	1
	300	300	1
	600	600	1
	1200	1200	1
	1800	1800	1
	2400	2400	1
	4800	4800	1
	7200	7200	1
	9600	9600	1
Exit SET-UP mode.	SET-UP light stops flashing and the ON-LINE light goes on.		

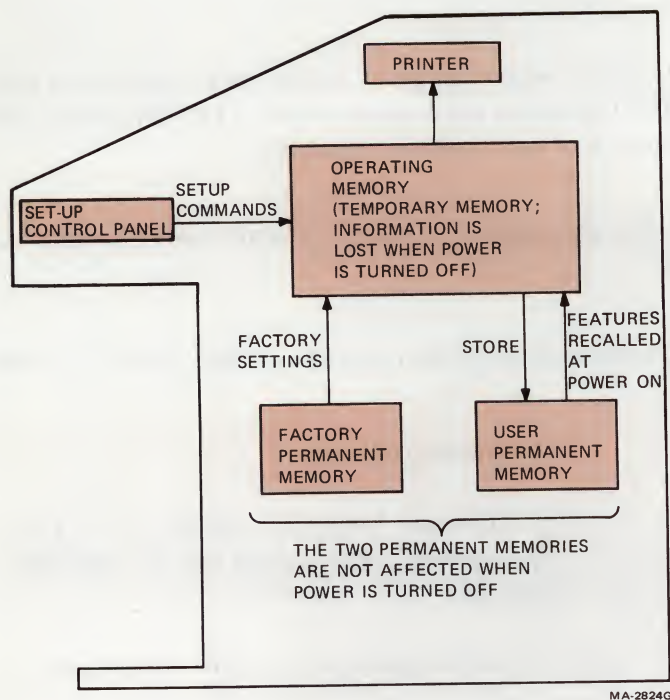


Figure 1-12 Store/Recall Feature

STORE/RECALL Feature

The LA120-RA contains one operating (temporary) memory and two permanent memories (Figure 1-12). The LA120-RA operates from the operating memory. The information contained in the operating memory is lost when power is turned off.

User permanent memory is used to store the SET-UP features (forms length, baud rate, etc.). When power to the LA120-RA is turned on, information in the user permanent memory is loaded into the operating memory. The LA120-RA then uses this information during operation.

Factory permanent memory is a read only memory that contains the original factory settings. If SET-UP information is not stored in the user permanent memory the factory stored settings are loaded into the operating memory.

NOTE:

No power or batteries are required to retain information in the permanent memories.

STORE

Normally, setting up the LA120-RA is a one-time job. This is due to a unique feature which stores the SET-UP feature settings in user permanent memory. The LA120-RA power can be turned off without losing the following settings.

Horizontal tab stops*	Form length‡
Vertical tab stops*	Horizontal pitch†
Left margin*	Modem/protocol†
Right margin*	Parity/data bits†
Top margin*	Secondary channel†
Bottom margin*	Break action†
Baud rate†	Vertical pitch*
Printer character set	Printer NL character*
Alternate character set*	XON†
Auto disconnect†	

When power to the LA120-RA is turned on, the LA120-RA will automatically use the last settings stored in the user permanent memory. Current column and line numbers are not saved.

NOTE: Temporarily stored SET-UP features and current position will be lost if power is turned off when installing a new ribbon.

Perform the following procedure to store the selected SET-UP features in user permanent memory.

Procedure	Comments/Indication
Enter SET-UP mode.	SET-UP light flashes and the ON-LINE light goes off.
Press STORE .	All settings in the operating memory are stored in user permanent memory. The numeric display will go blank for a few seconds.
Exit SET-UP mode.	SET-UP light stops flashing and the ON-LINE light goes on.

* These features may be changed by the remote device.

† These features may be changed by the operator.

‡ These features may be changed by the operator and/or the remote device.

FACTORY STORED SETTINGS

The initialize sequence causes the LA120-RA to recall factory stored SET-UP features listed in Table 1-3. Perform the following procedure to recall factory stored settings.

1. Turn the power ON/OFF switch off.
2. Press and hold the ON LINE/OFF LINE button.
3. Turn the power ON/OFF switch on while holding the ON LINE/OFF LINE button.
4. Release the ON LINE/OFF LINE button.

NOTE: The factory stored settings cannot be recalled by the remote device.

The LA120-RA features are originally set at the factory to the values listed in Table 1-3.

Table 1-3 Factory Stored Settings

Feature	Setting
Horizontal tab stops*	Column 1, 9, 17, 25, 33, 41, 49, 57, 65, 73, 81, 89, 97, 105, 113, 121, 129, 137, 145, 153, 161, 169, 177, 185, 193, 201, 209, 217
Vertical tab stops*	Lines 1, 9, 17, 25, 33, 41, 49, 57, 65, 73, 81, 89, 97, 105, 113, 121, 129, 137, 145, 153, 161
Left margin*	Column 1
Right margin*	Column 132
Top margin*	Line 1
Bottom margin*	Line 66
Active position*	Column 1, line 1
Baud rate†	1200
Printer character set*	US ASCII
Alternate character set	Off
Auto disconnect†	On
Form length‡	66 lines per form
Horizontal pitch†	10 characters per inch
Modem/protocol†	1
Parity/data bits†	1
Secondary channel†	Speed control mode (0)
Break action†	On
Vertical pitch*	6 lines per inch
Printer NL character*	No new line
XON†	On

* These features may be changed by the remote device

† These features may be changed by the operator.

‡ These features may be changed by the operator and/or the remote device.

PART 4 RIBBONS, FORMS, AND PRINT IMPRESSION

INSTALLING RIBBON

The ribbon used in the LA120-RA will provide approximately five to six hours of continuous printing.

When the print contrast becomes too light, the ribbon may be turned over to provide an additional two hours of printing, then it should be replaced.

CAUTION: Only DIGITAL-recommended ribbons (Part No. 36-12153-01) should be used in the LA120-RA. Use of other ribbons can damage the printhead and may void the warranty.

NOTE: Temporarily stored SET-UP features and current position will be lost if power is turned off when installing a new ribbon.

Perform the following procedure to install a new ribbon.

1. Press the ON LINE/OFF LINE button and wait until printing stops.
2. Open the top cover and release the ON LINE/OFF LINE button.
3. Move printhead adjustment lever to the last notch toward the operator (Figure 1-13).
4. Remove old ribbon, saving empty spool.
5. Install new ribbon as shown in Figure 1-13.

NOTE: Ribbon rivet must be on empty spool to make sure of correct operation of direction-changing mechanism.

6. Adjust impression (see Print Impression Adjustment section of this chapter).
7. Close top cover.

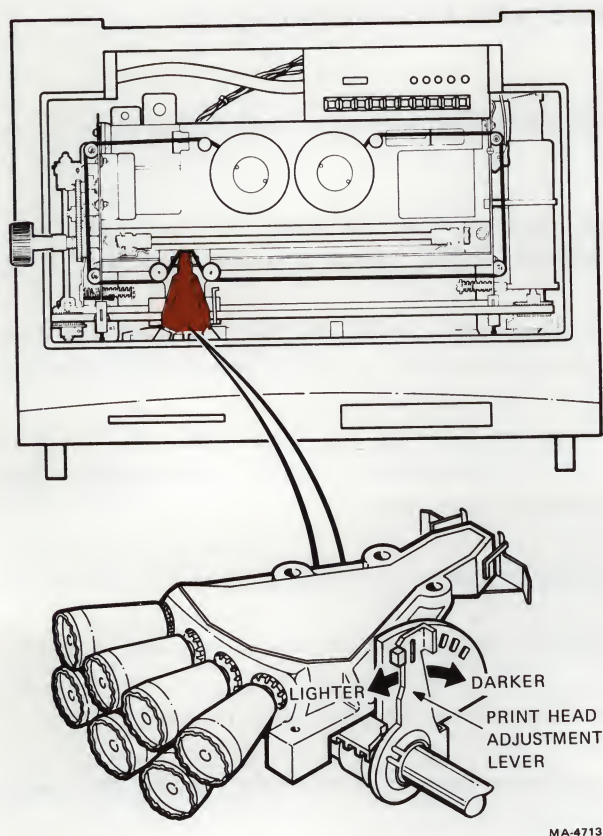


Figure 1-13 Ribbon Installation
(Top View)

LOADING PAPER/FORMS

The LA120-RA accepts sprocket-fed, multipart paper/forms ranging in width from 3 to 14-7/8 inches. (Refer to Installation, Interface Information, and Specifications chapter for paper specifications.)

- Multipart forms may have only one card part; the card must be the last part.
- Multipart carbonless forms up to six parts may be used. Ribbon must be used on the top copy.
- First-surface impact paper is not recommended unless ribbon is used.

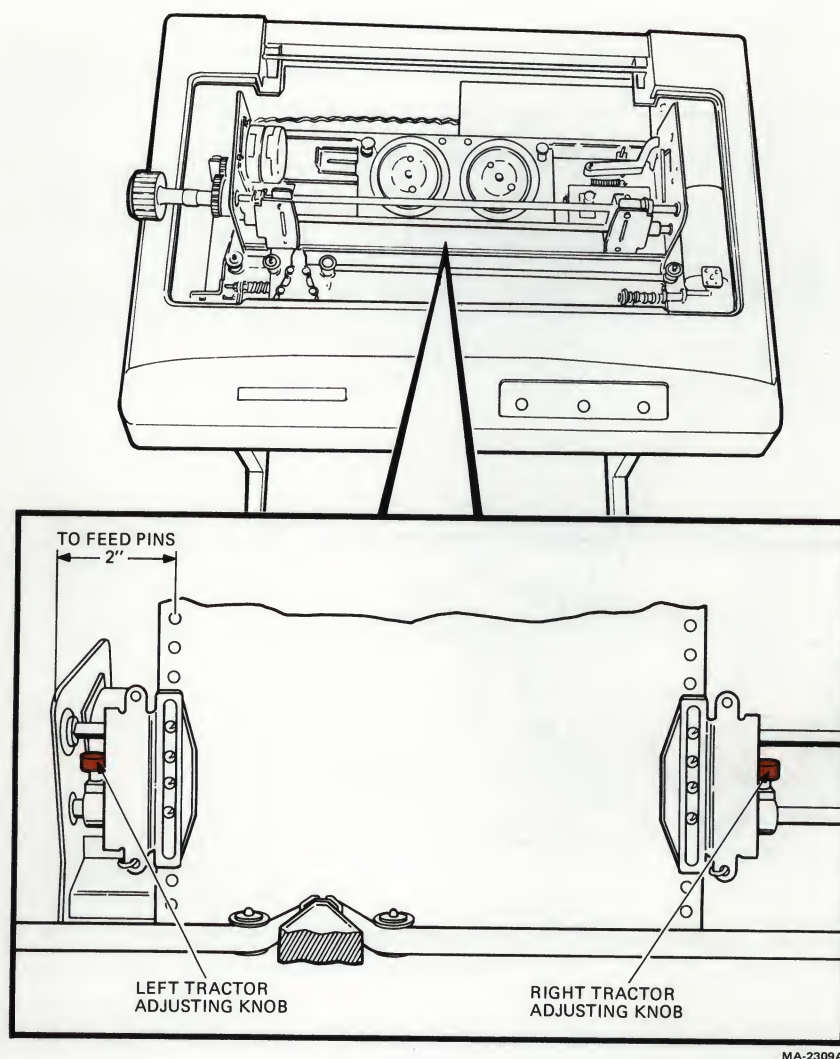
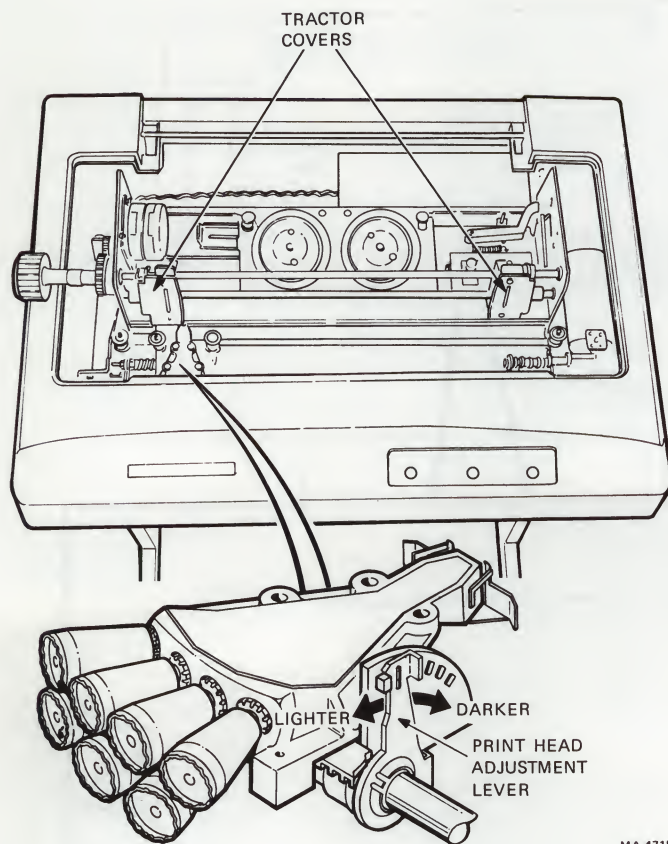


Figure 1-14 Tractor Adjust Knobs

Initial Paper/Forms Loading

Perform the following procedure to load paper forms.

1. Turn the power ON/OFF switch off and open the top cover.
2. Loosen the left and right tractor adjusting knobs (Figure 1-14).
3. Position the left tractor feed pins approximately 2 inches from the left side plate (Figure 1-14). Tighten the left tractor adjusting knob. This provides optimum margins for 132-column paper. It may be necessary to change the tractor adjustment when using preprinted forms.



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Figure 1-15 Tractor Covers/Carriage Adjustment Lever

4. Open both tractor covers and move the printhead adjustment lever to the last notch toward the operator (Figure 1-15).
5. Place the paper/forms on the floor between the legs of the LA120-RA. The leading edge of the paper must be parallel to the paper slot with the left edge of the paper in line with the left tractor (Figure 1-16).
6. Feed the paper up through the paper slot. Align the left margin holes over the feed pins and close the left tractor cover.
7. Align the right margin holes over the feed pins, tighten the right tractor adjusting knob, and close the right tractor cover.

NOTE: If the paper pulls against the tractor pins or bows in the middle, readjust the right tractor.

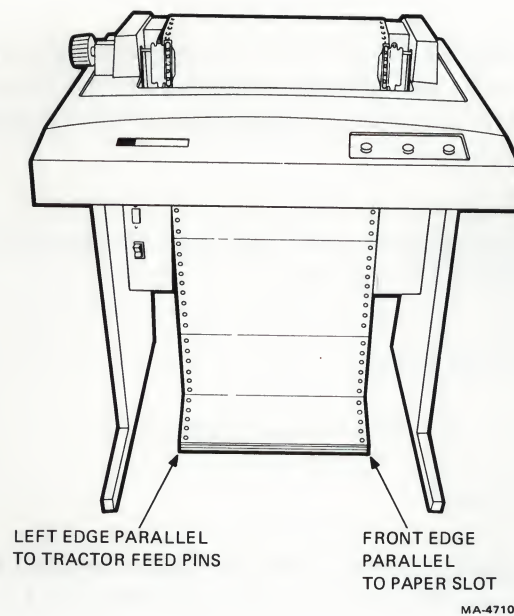


Figure 1-16 Loading Paper Forms

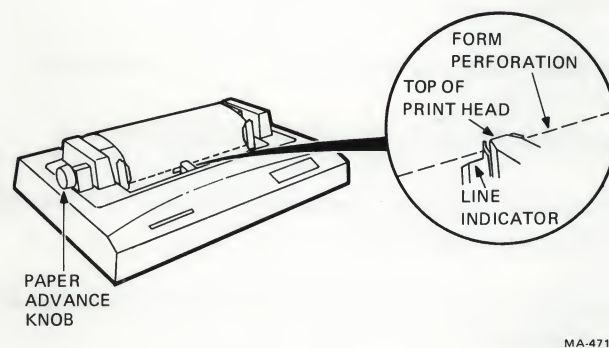


Figure 1-17 Aligning Top of Form

8. Close top cover.
9. Turn the power ON/OFF switch on.
10. Perform the print impression adjustment (see Print Impression Adjustment section of this chapter).
11. Use the paper advance knob to set the form perforation half way between the line indicator and the top of the printhead (Figure 1-17).

Reloading Paper/Form

The LA120-RA operates until the physical end of the form passes the printhead. When print operation stops, the PAPER OUT indicator light goes on, and the bell tone is turned on for five seconds. The operator must then perform the following procedure.

NOTE: Do NOT turn power off when reloading paper, otherwise the temporarily stored features, data, and current position will be lost.

1. Press the ON LINE/OFF LINE button.
2. Open top cover and release the ON LINE/OFF LINE button.
3. Open tractors and load paper.
4. Use the paper advance knob to set the form perforation half way between the line indicator and the top of the printhead (Figure 1-17).
5. Close top cover.

PRINT IMPRESSION ADJUSTMENT

Perform the following procedure to adjust the print impression.

1. Press the ON LINE/OFF LINE button and wait until printing stops.
2. Open top cover and release the ON LINE/OFF LINE button.
3. Use the printhead adjustment lever, as shown in Figure 1-15, to adjust printhead for contact with paper forms.
4. Move the printhead and carriage sideways by hand to check for form smudging or paper rippling.
5. Close top cover.
6. Press and hold the ON LINE/OFF LINE button to place the printer in off-line mode.
7. Press and release the SELF-TEST button. (The self test pattern is printed. See Figure 1-18 for a sample printout.)
8. Release the ON LINE/OFF LINE button.
9. Press the SELF-TEST button to stop the self-test and to place the LA120-RA on-line.
10. If smudging or rippling occurs, press the ON LINE/OFF LINE button, open the top cover and move the printhead adjustment lever away from the paper one notch (towards operator). Close the top cover and repeat steps 6-10.

CAUTION: Printhead life will be considerably shortened if the print impression adjustment procedure is not adhered to.

```
$%&'()*+,-./0123456789:;<=>?@ABCD
%&'()*+,-./0123456789:;<=>?@ABCDE
&'()*+,-./0123456789:;<=>?@ABCDEF
'()*+,-./0123456789:;<=>?@ABCDEFG
()*+,-./0123456789:;<=>?@ABCDEFGH
)*+,-./0123456789:;<=>?@ABCDEFGHI
*+,-./0123456789:;<=>?@ABCDEFGHIJ
+,-./0123456789:;<=>?@ABCDEFGHIJK
,-./0123456789:;<=>?@ABCDEFGHIJKL
-./0123456789:;<=>?@ABCDEFGHIJKLM
```

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Figure 1-18 Self Test Example

PART 5 WHAT TO DO BEFORE REQUESTING SERVICE

INTERNAL SELF-TEST

The LA120-RA will run an internal self test when power is turned on. A failure is displayed by a flashing number in the numeric display. If a failure occurs, remove and restore power to the printer. If the error indication reappears, record the indication and call for service. If the numeric display indicates a constant 8888 when power is turned on, the top cover is open or a paper fault condition exists.

NOTE: If the original problem was indicated by a flashing 9 and was solved by reapplying power, then the factory defaults are stored in user permanent memory. Check the stored SET-UP features to make sure they have not been affected, then store features again. (See SET-UP features section of this chapter.)

PRINTING SELF-TEST

An additional test is the printing self test which may be initiated by the operator. This test will help to verify proper operation of the printer by printing a pattern of characters within the currently selected margins (Figure 1-18).

Perform the following procedure to initiate the self test procedure:

1. Press and hold the ON LINE/OFF LINE button to place the printer in off-line mode.
2. Press and release the SELF-TEST button. The self test pattern is printed. (See Figure 1-18 for a sample self test printout.)
3. Release the ON LINE/OFF LINE button.
4. Press the SELF-TEST button to stop the self test and to place the LA120-RA on-line.

OPERATOR TROUBLESHOOTING

If you are unable to turn power on to the printer, or if the printer appears to be faulty, refer to Table 1-4, Operator Troubleshooting. This table describes symptoms an operator can check prior to requesting service.

Table 1-4 Operator Troubleshooting

Symptom	Possible Cause and Corrective Action
LA120-RA will not turn on when the ON/OFF switch is set to on	AC power cord is not plugged into wall outlet or front of printer; plug in cord.
No head movement	
No indicators	There is a loss of power from the wall outlet; check outlet with a known working electrical device (such as a lamp). If there still is no power, call your electrician.
	AC line fuse has blown; turn the LA120-RA off and have the fuse replaced. (See Figure 1-2 for fuse replacement.)
Characters will not print	LA120-RA is out of paper; load (See the Ribbons, Forms, and Print Impression section of this chapter for paper loading.)
	LA120-RA top cover is open or ajar; close cover.
	Printhead is too far from paper; readjust the printhead adjustment lever. (See the Ribbons, Forms, and Print Impression section of this chapter for adjustment.)
	Data set is unplugged; plug it in.
	The communication setup is incorrect. Make sure that the LA120-RA is set up properly for the communication equipment in use (see SET-UP Features section of this chapter).
Light print	Printhead is too far from paper; readjust the printhead adjustment lever.
	Ribbon is out of ink; reverse or replace the ribbon. (See the Ribbons, Forms, and Print Impression section of this chapter for ribbon replacement.)
<p><i>NOTE: Turn the ribbon over after five to six hours of continuous printing. The ribbon can be turned over only once, then must be replaced.</i></p>	
Paper does not advance	Paper is not loaded properly; check that the tractor covers are closed and the feed holes are properly aligned.
	Feed holes are torn; reload paper. If the paper pulls against the tractor pins or bows in the middle, readjust the right tractor.

Table 1-4 Operator Troubleshooting (Cont)

Symptom	Possible Cause and Corrective Action
Paper tearing or smudging	Printhead is exerting too much pressure on the paper; readjust the printhead adjustment lever.
	Tractors are incorrectly adjusted. If the paper pulls against the tractor pins or bows in the middle, readjust the right tractor.
	Paper is not set horizontally in printer; realign paper.
Printhead jam	Paper source is not positioned below paper slot. Paper or printhead has jammed; clear the jam.
Garbled characters or double characters	The communication setup is incorrect. Make sure that the LA120-RA is set up properly for the communication equipment in use. (See SET-UP Feature section of this chapter.)



CHAPTER 2

PROGRAMMING INFORMATION

GENERAL

Chapter 2 discusses the implementation of control functions using control characters, escape sequences, control sequences and control strings. Also, the terms used in control and escape sequences are defined. The methods used to regulate the input buffer are explained, and fill time formula calculations are provided at the end of the chapter.

CONTROL FUNCTIONS

A control function provides control of the printing, processing, transmission, and representation of data. Control functions are implemented through the use of control characters, escape sequences, control sequences, and control strings. In this way the remote device can command the LA120-RA to change form settings, change modes, ring the bell, select character sets, etc.

ANSI standards have been established to create a flexible and comprehensive system of transmitting format and editing information. The ANSI standards provide the following major advantages.

1. The standards are well defined and documented. This greatly decreases the chances of incompatible implementations.
2. The standards have ample provisions for future expansion without sacrificing compatibility with older programs. The syntax used in ANSI controls allows a large number of new controls to be added easily.
3. The standards are compatible with all frequently used communication protocols. In contrast, many other standards use control codes that are reserved for communication functions. In these other standards, codes used for line turnaround, disconnect and synchronization get confused with those used to send parameter values.

For LA120-RA features lacking an ANSI standard control function, additional control functions have been defined within the extensions permitted by the ANSI standards.

CONTROL CHARACTERS

A control character is a single character whose occurrence in a particular context initiates, modifies or stops a control function. The value of a control character is in the octal range of 0 through 37 and 177.

The control characters recognized by the LA120-RA are shown in Table 2-1 and described in the following paragraphs. All other control codes are ignored by the LA120-RA.

Table 2-1 Received Control Characters

Code	Mnemonic	Name
000	NUL	Null
003	ETX	End of Text
004	EOT	End of Transmission
007	BEL	Bell
010	BS	Backspace
011	HT	Horizontal Tabulation
012	LF	Line Feed
013	VT	Vertical Tabulation
014	FF	Form Feed
015	CR	Carriage Return
020	DLE	Data Link Escape
030	CAN	Cancel
032	SUB	Substitute
033	ESC	Escape
177	DEL	Delete

NOTE: Caution should be used when operating the LA120-RA using ETX or EOT as turnaround characters with Modem Selection 4 or 5 as the printer (operator) cannot generate turnaround characters.

Null or Delete (NUL OR DEL)

These characters are used for timing and cause no printer operation. These characters are disposed of without occupying space in the input buffer of the LA120-RA. The null and delete characters may be used as fill characters to decrease the effective data reception speed (throughput speed) of the LA120-RA.

End of Text (ETX)

If the LA120-RA is operating in half-duplex with ETX turnaround, this character's octal code (003) is recognized as the turnaround character. If the LA120-RA is operating in any other full- or half-duplex mode, the ETX character has no effect. (See the Communication Information chapter for further information concerning the ETX turnaround character).

End of Transmission (EOT)

If the LA120-RA is operating in half-duplex with EOT turnaround, this character's octal code (004) is recognized as the turnaround character. If the LA120-RA is operating in any other full- or half-duplex mode, the EOT character is recognized as

a disconnect request, unless the auto disconnect feature is turned off. For disconnect request in half-duplex with EOT turnaround, see the Data Link Escape (DLE) discussion in this section. (See the Communication Information chapter for further information concerning the EOT turnaround character.)

Bell (BEL)

This character sounds a momentary 2400 Hertz tone. No more than eight bell characters can be pending at any one time. Any subsequent bell characters are ignored.

Backspace (BS)

This character decrements the active column. (Active column is defined as the column where the next character will normally be printed.) If the active column is at the left margin, the backspace character is ignored. (See the discussion on Active Column in this chapter).

Horizontal Tabulation (HT)

This character advances the active column to the next horizontal tab stop. The tab stop must be greater than the current active column but no greater than the right margin. If no such tab stop exists, the active column is advanced to the column after the right margin.

Line Feed (LF)

This character increments the active line. If the active line is at the bottom margin, the active line is set to the top margin of the next page. If line feed new line mode is enabled, the active column is set to the left margin.

Vertical Tabulation (VT)

This character advances the active line to the next vertical tab stop. The tab stop must be greater than the current active line, but no greater than the bottom margin. If no such tab stop exists, the active line is set to the top margin of the next page. If line feed new line mode is enabled, the active column is set to the left margin.

Form Feed (FF)

This character advances the active line to the top margin of the next page, which may or may not be the physical top of the form. If line feed new line mode is enabled, the active column is set to the left margin.

Carriage Return (CR)

This character returns the active column to the left margin.

Data Link Escape (DLE)

If the LA120-RA is operating in half-duplex with EOT turnaround, this character causes the EOT character to be interpreted as a disconnect request, only if the DLE character is received or transmitted immediately prior to the EOT. If the LA120-RA is operating in any other full- or half-duplex mode, the DLE character has no effect. The DLE is ignored if the next character is not an EOT. (See Communication Information chapter for further information concerning DLE).

Cancel (CAN)

This character terminates any pending control or escape sequence and causes that sequence to be ignored.

Substitute (SUB)

Characters received with parity errors are converted to the SUB character. If characters are ever lost due to an input buffer overflow, a SUB character is placed in the input buffer at that point. The SUB character is printed as the graphic symbol: \mathbb{X} . The SUB character also has the effect of a cancel character.

Escape (ESC)

This character is interpreted as introducing a control or escape sequence.

CONTROL AND ESCAPE SEQUENCES

The control and escape sequences used by the LA120-RA are a subset of those specified in the ANSI specifications X3.64 1977, X3.4 1977 and X3.41 1974. None of the characters in an ANSI sequence are printed. When the end of the sequence is found (or an error occurs), the LA120-RA reverts to its normal printing mode.

If a sequence is received by the LA120-RA that it does not support, the sequence is ignored. A sequence that has been only partially processed when the LA120-RA enters SET-UP mode will be completed when SET-UP mode is exited.

In the list of escape and control sequences contained within this chapter, the escape character (octal 033) is designated as ESC. Numeric parameters are shown either as a number or designated as n , n_1 , n_2 , etc. The numeric parameters are interpreted as unsigned decimal integers. The most significant digit is transmitted first. Leading zeros are allowed but are not necessary. Plus and minus signs are not allowed in numeric parameters. The *** character is used to indicate the three digit octal representation of the variable parameter within the control or escape sequence.

Control characters (characters with octal codes 000 through 037 and 177) may be imbedded anywhere within a control or escape sequence. The occurrence of an imbedded control character is technically an error condition. However, the ability to imbed control characters allows the XON and XOFF characters to be interpreted properly without effecting the control or escape sequence. To recover from an imbedded control character the LA120-RA executes the control character as soon as it is encountered. The processing of the control sequence then continues with the next character received. Exceptions to this are if the character ESC occurs, or if the current control or escape sequence is aborted and a new one commences beginning with the ESC just received.

If the CAN (030) character or SUB (032) character is received, the current control or escape sequence is aborted.

Sequence Definitions

The following paragraphs provide the basic definitions of terms used in the remainder of this chapter.

Control Sequence Introducer (CSI) – An escape sequence that provides supplementary controls and is itself a prefix affecting the interpretation of a limited number of contiguous characters. The CSI for the LA120-RA is ESC [(octal 033 133).

Intermediate Character – A character whose position follows the CSI and precedes a final character in a control or escape sequence.

Numeric Parameter (Pn or n) – A numeric parameter is a decimal number represented by a string of ASCII decimal digits, (octal codes 060 through 071).

Default – A missing parameter is interpreted as a zero. A zero is interpreted as a place holder; that is, unless a numeric parameter is specified the previous value of that parameter will be assumed.

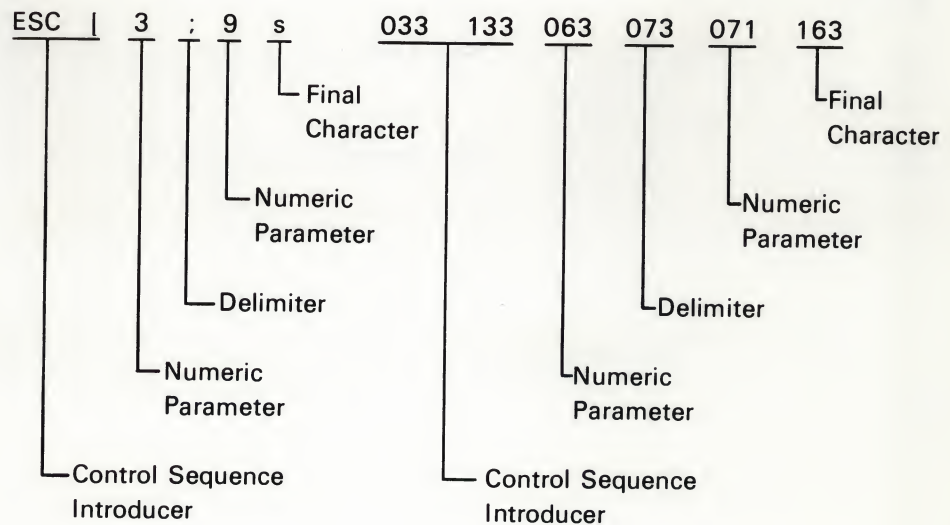
Delimiter – A character used to fix the boundary of a variable parameter.

Final Character – A character whose bit combination terminates an escape or control sequence.

Sequence Example – The following sequence is used to set horizontal tabs.

ASCII Representation of Sequence

Octal Representation of Sequence



CONTROL AND ESCAPE SEQUENCES RECEIVED

The following paragraphs describe in detail the escape and control sequences that the LA120-RA responds to. These sequences are arranged as follows.

- Printable character sets
- Active column and active line
- Line feed new line mode
- Horizontal pitch
- Horizontal margins
- Horizontal tabs
- Vertical pitch
- Form length
- Vertical margins
- Vertical tabs
- Product identification

USASCII/UK Printable Character Sets

The LA120-RA is capable of receiving (printing) two distinct character sets; the United States ASCII character set (USASCII), and the United Kingdom character set (UK). The USASCII and UK character sets contain both control characters and printable characters. The character sets differ only by one character. The # character of the USASCII code is replaced by the £ character of the UK character set. The USASCII and UK printable character sets are shown in Table 2-2. (Refer to the Option Information chapter for the optional national and APL character sets.)

The following sequences select either the USASCII or UK character sets.

Sequence	Function
ESC (A 033 050 101	Select UK character set
ESC (B 033 050 102	Select USASCII character set

Table 2-2 USASCII/UK Printable Character Set

Code	Char	Code	Char	Code	Char
040	space	100	@	140	\
041	!	101	A	141	a
042	"	102	B	142	b
043	#	103	C	143	c
044	\$	104	D	144	d
045	%	105	E	145	e
046	&	106	F	146	f
047	'	107	G	147	g
050	(110	H	150	h
051)	111	I	151	i
052	*	112	J	152	j
053	+	113	K	153	k
054	,	114	L	154	l
055	-	115	M	155	m
056	.	116	N	156	n
057	/	117	O	157	o
060	0	120	P	160	p
061	1	121	Q	161	q
062	2	122	R	162	r
063	3	123	S	163	s
064	4	124	T	164	t
065	5	125	U	165	u
066	6	126	V	166	v
067	7	127	W	167	w
070	8	130	X	170	x
071	9	131	Y	171	y
072	:	132	Z	172	z
073	;	133	[173	{
074	<	134	\	174	
075	=	135]	175	}
076	>	136	•	176	~
077	?	137	^	177	⌘

Active Column and Active Line

Active column is defined as the column where the next character will normally be printed. Active line is defined as the line where the next character will normally be printed. Column and line numbers begin with one, not zero. Printable characters normally increment active column. Active column and active line together are known as active position.

Active position is only loosely linked to the physical position of LA120-RA print-head and paper mechanism. In general, the active column is only recorded when a character is actually printed. Any previous history of active column values is not significant. The active line is different from active column in that active line may only be advanced, since backward paper motion is not allowed. When the LA120-RA is idle, the active and physical positions are identical.

In the LA120-RA, bell characters have only an active line attribute. Bell characters are not guaranteed to sound off at any particular physical column within a line.

In addition to the normal position control characters (space, backspace, carriage return, line feed, horizontal tab, vertical tab, and form feed) the following sequences modify active position.

Sequence	Function/Comments
ESC n \ 033 133 *** 140	Set active column to column n. Where left margin $\leq n \leq$ right margin, if $n \geq$ right margin then active column is set to LM and active line is incremented by 1.
<i>NOTE: The "***" character is used to indicate the three digit octal representation of the variable parameter within the control or escape sequence.</i>	
ESC n a 033 133 *** 141	Advance active column by n columns.
ESC E 033 105	Set active column to left margin and increment active line by 1.
ESC D 033 104	Increment active line (active column unchanged) by 1.
ESC n d 033 133 *** 144	Set active line to line n as measured from the top of form.
ESC n e 033 133 *** 145	Advance active line by n lines.

Line Feed New Line Mode

When this mode is enabled, the line feed, vertical tab, and form feed characters received return the active column to the left margin in addition to their normal functions. The following sequences control line feed new line mode.

Sequence	Function/Comments
ESC 2 0 h 033 133 062 060 150	Enable line feed new line mode
ESC 2 0 1 033 133 062 060 154	Disable line feed new line mode

Horizontal Pitch

Horizontal pitch determines the width and space between the printed characters. The LA120-RA has eight different horizontal pitches. Any combination of pitches may be used on a single print line. Changing horizontal pitch modifies active column. The resulting new active column is that of the first column boundary at or to the right of the physical position of the previous active column in the old pitch. It is calculated as:

$$\text{Newcol} = 1 + \frac{(\text{Oldcol} - 1) * \text{Oldpitch}}{\text{Newpitch}}$$

where:

Newcol	= new active column
Newpitch	= new pitch in chars/inch
Oldcol	= old active column
Oldpitch	= old pitch in chars/inch

The division performed is integer division. Any remainder or fractional part of the quotient is discarded. The following sequences set horizontal pitch.

Sequence	Function/Comments
ESC w 033 133 167	10 char/inch
ESC 0 w 033 133 160 167	10 char/inch
ESC 1 w 033 133 061 167	10 char/inch
ESC 2 w 033 133 062 167	12 char/inch
ESC 3 w 033 133 063 167	13.2 char/inch
ESC 4 w 033 133 064 167	16.5 char/inch
ESC 5 w 033 133 065 167	5 char/inch
ESC 6 w 033 133 066 167	6 char/inch
ESC 7 w 033 133 067 167	6.6 char/inch
ESC 8 w 033 133 070 167	8.25 char/inch

Horizontal Margins

Printing is permitted only within the inclusive left and right margins. A carriage return character sets the active column to the left margin. Attempting to move the active column to the left of the left margin sets the active column to the left margin. Attempting to move the active column more than one column to the right of the right margin causes the active column to equal the left margin plus one line feed. Horizontal margins may be set as long as the following is true.

$$1 \leq \text{left margin} \leq \text{right margin} \leq \text{max column}$$

NOTE:

Max column is affected by the horizontal pitch setting. Max column must be re-computed whenever the horizontal pitch is changed.

Max column = 13.2 inches × horizontal pitch where the product is rounded down to the nearest column. The following sequences set the left and right margins.

Sequence	Function/Comments
ESC [n s 033 133 *** 163	Set left margin to column n.
ESC [n ; 0 s 033 133 *** 073 060 163	Set left margin to column n.
ESC [; n s 033 133 073 *** 163	Set right margin to column n.
ESC [0 ; n s 033 133 060 073 *** 163	Set right margin to column n.
ESC [n ₁ ; n ₂ s 033 133 *** 073 *** 163	Set left margin to column n ₁ and set right margin to column n ₂

Horizontal Tabs

The LA120-RA has 217 possible horizontal tab stops, one for each column. Tab stops are associated with column numbers, not physical positions on the paper. Thus, changing horizontal pitch will also change the physical position of tab stops. Each stop may be set or cleared independently. Setting a stop already set has no effect; the same is true for clearing a stop already cleared. Tab stops may be set or cleared without regard to margins or horizontal pitch.

Sequence	Functions/Comments
ESC H 033 110	Set horizontal tab stop at active column.
ESC 1 033 154	Set horizontal tab stop at active column.
ESC g 033 133 147	Clear horizontal tab stop at active column.
ESC 0 g 033 133 060 147	Clear horizontal tab stop at active column.
ESC 2 g 033 133 062 147	Clear all horizontal tab stops.
ESC 3 g 033 133 063 147	Clear all horizontal tab stops.
ESC 2 033 062	Clear all horizontal tab stops.
ESC n u 033 133 *** 165	Set horizontal tab stop at column n.
ESC n ₁ ; n ₂ ; ...n _x u 033 *** 073 *** 073 ...*** 165	Set horizontal tab stops at columns n ₁ ; n ₂ ; ...n _x (x ≤ 16).

Vertical Pitch

Vertical pitch determines the spacing between the lines printed. The height of printed characters is not affected by this feature. Changing vertical pitch does not affect active line number, but it does clear vertical margins. In addition, changing vertical pitch alters the form length and the position of the vertical tabs. The following sequences sets vertical pitch.

NOTE: Changing vertical pitch alters the form length and the position of vertical tabs. When changing vertical pitch, reset the forms length feature to the correct setting.

Sequence	Functions/Comments
ESC z 033 133 172	6 lines per inch
ESC 0 z 033 133 060 172	6 lines per inch
ESC 1 z 033 133 061 172	6 lines per inch
ESC 2 z 033 133 062 172	8 lines per inch
ESC 3 z 033 133 063 172	12 lines per inch
ESC 4 z 2 033 133 064 172	2 lines per inch
ESC 5 z 033 133 065 172	3 lines per inch
ESC 6 z 033 133 066 172	4 lines per inch

Form Length

Form length is measured in lines per form. Therefore, changing vertical pitch will alter the physical form length. Forms may be from 1 to 168 lines in length. Changing form length clears vertical margins and defines the current line as line one. The following sequence sets form length.

Sequence	Function/Comments
ESC n t 033 133 *** 164	Set form length to n lines. Set top margin to line 1. Set bottom margin to line n. Set active line to line 1.

Vertical Margins

Printing is permitted only on lines within the inclusive top and bottom margins. When vertical pitch or form length are changed, these margins are cleared; that is, the top margin is set to line one and the bottom margin is set to the form length. The following must be true to successfully set new vertical margins.

Top margin ≥ 1
 Bottom margin \geq Top margin
 Form length \geq Bottom margin

Attempting to print above the top margin or below the bottom margin will automatically advance the active line to the top margin of the next page. For example, a line feed performed at the bottom margin will execute a form feed.

The following sequences set the top and bottom margins.

Sequence	Function/Comments
ESC [n r 033 133 *** 162	Set top margin to line n.
ESC [; n r	
ESC [0 ; n r 033 133 060 073 *** 162	Set bottom margin to line n.
ESC [n ₁ ; n ₂ r 033 133 *** 073 *** 162	Set top margin to line n ₁ and set bottom margin to line n ₂ .

Vertical Tabs

The LA120-RA has 168 vertical tab stops that are set and cleared similar to horizontal tab stops. Vertical tab stops are associated with specific line numbers, not physical positions on the paper. Thus, changing vertical pitch changes the printing position of vertical tabs on the paper. The following sequences set or clear vertical tab stops.

Sequence	Function/Comments
ESC J 033 112	Set vertical tab stop at active line.
ESC 3 033 063	Set vertical tab stop at active line.
ESC 1 g 033 133 061 147	Clear vertical tab stop at active line.
ESC 4 g 033 133 064 147	Clear all vertical tab stops.
ESC 4 033 064	Clear all vertical tab stops.
ESC n v 033 133 *** 166	Set vertical tab stop at line n.
ESC n ₁ ; n ₂ ; ...n _x v 033 133 *** 073 *** 073 ... 166	Set vertical tab stops at lines n ₁ , n ₂ , ...n _x (x < 16).

Product Identification

The LA120-RA terminal automatically transmits an answer to the ANSI standard request for a device attributes control sequence. The following sequence causes the LA120-RA to transmit its product identification control sequence.

Sequence	Function/Comments
ESC c 033 133 143	LA120-RA transmits ESC ? 2 c 033 133 077 062 143
ESC 0 c 033 133 060 143	LA120-RA transmits ESC ? 2 c 033 133 077 062 143

BUFFER CONTROL

When the LA120-RA receives characters (other than fill characters, NUL and DEL), it stores those characters in a 1000 character input buffer. When the printer is ready, characters are fetched from the input buffer and printed. If the printer falls behind by more than 1000 characters, the input buffer overflows and data is lost. Three methods are available to avoid buffer overflows.

1. Send data only as fast as it can be printed. When receiving data at 1200 baud or less, the LA120-RA can keep up with normal character code reception. However, very short lines and multiple form feeds cannot be printed this fast. Fill characters may be used to slow the effective data transmission speed (throughput speed) in these cases. (See Fill Time Formula section in this chapter for use of fill characters.)
2. Limit the number of characters in the message to the LA120-RA input buffer size. If the buffer is empty at the beginning of your transmission, you can send a message of about 1000 characters without causing a buffer overflow.
3. Use the XON SET-UP feature (XON set to 1) or restraint mode (secondary channel set to 1) to tell the data source when to pause in sending data and when to resume. These features allow for maximum throughput and eliminates the need for fill time character calculations and message size limits.

When XON or restraint mode is used, the LA120-RA constantly monitors the number of characters stored in its input buffer. When the number of characters in the input buffer exceeds 576 characters, the LA120-RA signals the data source to stop sending data. Meanwhile, the printer continues to take characters out of the input buffer. When the number of characters remaining in the input buffer is less than 256 characters, the LA120-RA signals the data source that transmission may resume. (See Option Information chapter for information concerning the expanded buffer option.)

The LA120-RA sends a pause request when the printer is not ready, due to error conditions or operator actions. Error conditions include paper out or a printhead jam condition. The operator can also induce a pause request by pressing and holding the ON LINE/OFF LINE button. To maintain the pause condition open the top cover after printer activity stops.

Restraint mode operation is suited for local, hard-wired installations, especially when the LA120-RA is used as a serial line printer replacement. To select restraint mode, the modem SET-UP feature must be set for full-duplex (modem 1 or 2) and the secondary channel SET-UP feature must be set to 1.

XON/XOFF is suitable for either local or remote operation, as long as the communication connection is full-duplex. To select XON/XOFF operation the XON SET-UP feature must be set to 1.

If the XON feature is enabled, the LA120-RA will transmit XON when first powered up and transmit enabled. (See Communication Information chapter for transmit enabled conditions.)

Fill Time Formulas

When receiving data at 1200 baud or less, the LA120-RA can keep up with normal character code reception. Very short lines and multiple form feeds cannot be printed this fast. Fill characters (NUL and DEL) may be used to slow the effective data transmission speed in these cases. Fill characters do not enter the receive buffer of the LA120-RA. They are used by the remote device for data transmission timing.

The printhead and form movements (horizontal and vertical) of the printer are directly related to the fill time required to slow down the effective throughput of data. The fill time required to slow the effective data transmission to compensate for these movements can then be converted to the number of fill characters needed.

The number of fill characters required after a command to perform horizontal and/or vertical movement can be found using the following fill character formula.

$$\text{No. of fill characters} = \frac{\text{fill time required}}{\text{characters execution time required}}$$

Fill Time Required

Horizontal Movement – This includes horizontal tabs and horizontal positioning sequences.

Knowing the number of columns moved, allow 15 ms for each of the first ten columns (30 ms for double-width pitches: 5, 6, 6.6, 8.25) and 5.5 ms for each additional column (11 ms for double-width pitches: 5, 6, 6.6, 8.25) to determine the fill time requirement.

Character Execution Time

This time is given in milliseconds and is based on a given baud rate. The character execution time is the time it takes the remote device to slow down (monitor) the effective throughput of data to the LA120-RA input buffer. Character execution times at applicable baud rates are listed in Table 2-3.

The following computation is an example of fill time requirements for horizontal movement.

Assumed values: Baud rate = 2400
Horizontal pitch = single width

Table 2-3 Character Time Table

Baud Rate	Execution Times (ms)
300	33.3
600	16.6
1200	8.3
1800	5.5
2400	4.1
4800	2.0
7200	1.3
9600	1.0

NOTE: Times provided are for calculation of FILL TIME ONLY!

Also assume that horizontal tab stops are set at column 9, 17, 25 and printing is to start at column 9. The next two characters received are TAB TAB, then the number of fill characters that should follow is calculated as follows.

$$\begin{aligned}\text{No. of columns moved} &= (\text{final column} - \text{current column}) \\ 16 &= 25 - 9\end{aligned}$$

$$\begin{aligned}(15 \text{ ms} \times 10) &= 150 \text{ ms (15 ms/column for the first 10 columns)} \\ + (5.5 \text{ ms} \times 6) &= 33 \text{ ms (5.5 ms/column for the remainder)}\end{aligned}$$

Then use the fill time formula given above.

$$\begin{aligned}\text{No. of fill characters} &= 183 \text{ ms} / 4.12 \text{ characters} \\ \text{No. of fill characters} &= 44.6\end{aligned}$$

There are 45 (round up 44.6) fill characters (NUL or DEL) that should follow the two tabs.

Vertical Movement – This includes line feeds, vertical tabs, form feeds, and vertical positioning sequences. Convert the number of lines moved to the actual distance moved using the following formula.

$$\text{Inches moved} = \frac{\text{No. of lines moved}}{\text{Vertical pitch}}$$

Allow 33 ms for the first line moved up to 1/6 inch and 135 ms for each additional inch to determine the fill time requirement.

The following computation is an example of fill time requirements for vertical movement.

Assumed values: Vertical pitch = 6 lines/inch
 Baud = 1200
 Paper is at line 10

Also, assume the next characters received are nine line feeds.

Compute the number of fill characters as follows.

No. of inches moved = 9 lines/6 lines per inch
 No. of lines moved = 1-1/2 inches

1/6 inch = 33 ms
 + 1-2/6 inch \times 135 ms = 181 ms
 214 ms

Then use the above fill time formula.

No. of fill characters = 214 ms/8.3 ms
 No. of fill characters = 25.8 characters

Therefore 26 fill characters (NUL or DEL) should follow the nine line feeds



CHAPTER 3

COMMUNICATION INFORMATION

GENERAL

Chapter 3 discusses the selection and use of modem control protocols that are available to tailor the LA120-RA to meet specific communication requirements.

The modem SET-UP feature allows the operator to select a modem control protocol. Modem selections 1 and 2 are used to enable full-duplex communication, while selections 3, 4, and 5 are used to select half-duplex communication. The modem SET-UP feature choices are the following.

- Full-duplex without modem control
- Full-duplex with full modem control
- Half-duplex with supervisory control
- Half-duplex with EOT turnaround character
- Half-duplex with ETX turnaround character

FULL-DUPLEX

Full-duplex operation is a method of communicating that allows two devices to transmit and receive data simultaneously. There are two basic types of full-duplex operation: full-duplex with EIA control and full-duplex without EIA control. Both types of operation allow simultaneous transmission and reception of data. The LA120-RA generates both the data terminal ready (DTR) and request to send (RTS) signals. Full-duplex with EIA control requires that both the remote device and the LA120-RA recognize the proper EIA control signals before enabling communication. In full-duplex without EIA control selected, transmission and reception of data is always enabled.

The modem SET-UP feature is used to select the type of communication used by the LA120-RA. When using modem feature selection 1, the LA120-RA operates using full-duplex communication without EIA control. Signals sent to the LA120-RA, with the exception of receive data are ignored. The LA120-RA constantly turns on both the data terminal ready (DTR) and request to send (RTS) circuits. The primary situations for the use of this selection are:

1. Local connections (null modem operation)
2. Full-duplex modems or acoustic couplers where data set ready (DSR) and carrier detect [receive line signal detector (RLSD)] are not available.

NOTE: If the modem SET-UP feature is set to 1, the paper out printhead jam, cover open, or any other channel disconnect will not affect the DTR signal provided by the LA120-RA. (See Full- and Half-Duplex Hang Up sections for information relating to disconnects.)

With modem feature selection 2, the LA120-RA operates using full-duplex communication with full EIA control. Some of the equipment commonly used in this selection are the following.

1. Bell 103 data sets or equivalent that emulate 103 modems with regard to data set ready (DSR), carrier detect [receive line signal detector (RLSD)] and the ring indicator (RI) circuits.
2. Bell 212A modems or equivalent with speed control circuits.
3. Vadic 3400 full-duplex modems.

In this mode data terminal ready (DTR) is on, except during the 70 ms disconnect, a paper out, printhead jam, or cover open situation. A valid printer/modem link with the proper modem signals must be established for the LA120-RA to receive or transmit data.

Full-Duplex Hang Up

Hanging up the phone to disconnect from the line is accomplished by turning data terminal ready (DTR) off for 70 ms, and resetting all control lines to their initial state. Four line conditions that result in a disconnect sequence are the following.

1. Connection is not established within 20 seconds of a ring indication (RI). [Connection is defined as the on condition of data set ready (DSR) and carrier detect receive line signal detector (RLSD).]
2. Connections are established, and either ring goes on, data set ready (DSR) goes off, or carrier detect [receive line signal detector (RLSD)] goes off for five seconds.
3. When initiating a call and carrier detect [receive line signal detector (RLSD)] is not on within five seconds. Also see Effects of Paper Out section for detail on a paper out, printhead jam, or cover open situation.

Restraint Mode

The restraint line (when the secondary channel SET-UP feature set to 1) is controlled when the LA120-RA modem SET-UP feature is in either of the full-duplex modes. With restraint mode selected, the LA120-RA controls the secondary request to send line to signal an approaching input buffer overflow. This function is analogous to XON/OFF. This signal represents the status of the input buffer only, not a receive ready state. Data terminal ready (DTR) and secondary request to send (SRTS) are used to determine the receive state of the LA120-RA.

When speed control lines are selected restraint mode is disabled and secondary request to send (SRTS) no longer indicates the status of the input buffer.

Speed Control Mode

The speed lines are controlled when the (secondary channel SET-UP feature is set to 0). The LA120-RA will turn the speed select data signal rate selector (SPDS) line on if the operator selected baud rate is 1200 baud or higher. The LA120-RA will force an operating baud rate of 1200 baud if speed indicator (SPDI) is on via the modem. These speed selections are intended for Bell 212A modem operation.

HALF-DUPLEX

Half-duplex operation is a method of communicating that allows two devices to transmit and receive data in both directions, one direction at a time. Due to the "one at a time" definition of half-duplex, a method of defining which device is transmitting and which device is receiving at any point in time is required. Each time the transmitter and receiver exchange functions, the channel is "turned around." The channel is turned around depending on which device turns request to send (RTS) on. The RTS circuit is used to control the transmit/receive mode of the modem. The on condition of the request to send (RTS) circuit enables the generation of a carrier signal.

Also, when echo suppressors are on the line, it is necessary to turn them around in order to attenuate in the opposite direction.

The LA120-RA incorporates three methods of controlling line turnaround. In supervisory control mode the remote device controls all line turnarounds by manipulating the secondary channel. Reverse channel (secondary channel set to 1) is mandatory for this mode. The two other protocols (coded control with reverse channel and coded control without reverse channel) allow the transmitting device to control line turnaround, using specific control characters. If reverse channel is used, these lines provide confidence as to the fate of the transmitted data. Without these signals the transmission is "blind."

The following three half-duplex modes require a 202C, 202S or equivalent modem/acoustic coupler.

Modem 3

This is the first of three half-duplex modes, commonly referred to as supervisory mode. The remote device controls all line turnarounds by controlling the primary and secondary channels. The LA120-RA responds by switching between receive and transmit states and indicates that state to the remote device. No turnaround characters are received with this mode. Secondary channel is mandatory for this mode. When the LA120-RA originates a connection, use only half-duplex supervisory mode modem feature selection 3. The LA120-RA will attempt to enter transmit mode when originating a call which puts the burden of turning the line around on the remote device.

Modem 4

When half-duplex modem feature selection 4 is selected, line direction is controlled by the transmitting device. Line direction is established by the generation of the EOT turnaround character which indicates both ends must change state. Modem 5 is basically the same as modem feature selection 4, but the character used to control line turnaround is ETX.

When the LA120-RA is used to answer a call, half-duplex modes (4 or 5) with coded control and reverse channel (secondary channel set to 1) may be used with caution. In this situation the remote device must not issue the turnaround character. Also a data error may be misinterpreted as a turnaround sequence by the LA120-RA in which case the LA120-RA will attempt to enter transmit mode while the remote device is still in transmit mode. This will cause a disconnect.

Do not use modem feature selections 4 or 5 and coded control without reverse channel (secondary channel set to 0). In this situation a data error may be interpreted as a turnaround sequence which will cause both the remote device and the LA120-RA to attempt transmission. This could result in a hung line.

Initial Direction Determination

When the LA120-RA is initially put on-line, data can neither be transmitted nor received. When the printer is called, ring (RI) will turn on before data set ready (DSR). Most modems, in auto answer mode, will answer the call (go off hook) before turning data set ready (DSR) on, although some modems allow DSR to go on after a couple of rings, but before the call is answered. With this sequence the printer attempts to establish receive mode. If the LA120-RA operator is initiating the call, data set ready (DSR) will turn on when the modem is placed into data mode. Since data set ready (DSR) is on without ring indicator the terminal attempts to enter transmit mode.

Reverse Channel

Reverse channel is used for transmission of supervisory or error control signals. Reverse channel is comprised of two signals secondary request to send (SRTS) and secondary receive line signal detector (SRLSD). These signals flow in the opposite direction to which data is being transferred. Due to the relatively low bandwidth of the reverse channel (to the forward channel), it is not used for data exchange.

Half-Duplex Break

The half-duplex break operates in three modes.

1. Transmit mode (request to send) (on) – a space on the transmit data line for 233 ms
2. Receive mode (request to send) (off) – the on condition of the secondary request to send (SRTS) line for 233 ms, when operating with 'coded-no reverse channel' the break is ignored in receive mode
3. While switching modes – if neither receive nor transmit is enabled, the break will not be processed until a definite line direction is established

Loss of Data Set Ready

When data set ready (DSR) is lost, all control lines are set to their initial state.

Half-Duplex Hang Up

Hanging up the phone to disconnect from the line is accomplished by turning data terminal ready (DTR) off for 70 ms, and resetting all control lines to their initial state. There are five conditions that will cause a DTR disconnect.

1. Line connection is not established within 20 seconds of a ring indication. [Connection is defined as the on condition of data set ready (DSR) and carrier detect (receive line signal detector) (RSLD).]
2. When initiating a call with reverse channel, secondary carrier detect [secondary receive line signal detector (RSLD)] is not on within five seconds.
3. Line turnaround is not complete within five seconds.
4. Valid line direction is established and ring (RI) turns on or data set ready (DSR) drops.
5. There is a paper out, print-head jam, or cover open situation. (Refer to the following paragraph for detailed information concerning paper out, printhead jam and cover open conditions.

EFFECTS OF PAPER OUT

The LA120-RA operates until the physical end of paper passes the printhead; then printing stops.

- If the data source is using XON and XOFF, no additionally received data is lost.
- If auto disconnect is enabled, the data terminal ready (DTR) signal goes off during the paper out and recovery interval.
- If break is enabled, a break signal is sent when the paper out condition occurs.

The following paper out conditions will occur depending on the state of the auto disconnect, break, and XON SET-UP features.

	XON on Break enable on or off	XON off Break enable on	XON off Break enable off
Auto Disconnect off	XOFF	Break	No action
Auto Disconnect on	XOFF then DTR off	DTR off	DTR off

1. The first part of the document is a letter from the President of the United States to the Congress, dated January 1, 1861.

2. The second part is a report from the Secretary of the Treasury, dated January 1, 1861.

3. The third part is a report from the Secretary of the Interior, dated January 1, 1861.

4. The fourth part is a report from the Secretary of the Navy, dated January 1, 1861.

5. The fifth part is a report from the Secretary of the War, dated January 1, 1861.

6. The sixth part is a report from the Secretary of the State, dated January 1, 1861.

7. The seventh part is a report from the Secretary of the Army, dated January 1, 1861.

8. The eighth part is a report from the Secretary of the Navy, dated January 1, 1861.

9. The ninth part is a report from the Secretary of the War, dated January 1, 1861.

10. The tenth part is a report from the Secretary of the State, dated January 1, 1861.

11. The eleventh part is a report from the Secretary of the Army, dated January 1, 1861.

12. The twelfth part is a report from the Secretary of the Navy, dated January 1, 1861.

13. The thirteenth part is a report from the Secretary of the War, dated January 1, 1861.

14. The fourteenth part is a report from the Secretary of the State, dated January 1, 1861.

CHAPTER 4 INSTALLATION, INTERFACE INFORMATION, AND SPECIFICATIONS

GENERAL

Chapter 4 contains procedures for unpacking, packing, and inspecting, as well as terminal checkout procedures for the LA120-RA, to make sure that the unit was not damaged during shipment. These procedures will verify proper operation before connecting the LA120-RA to a communication system.

Install the LA120-RA in an area that is free of excessive dust, dirt, corrosive fumes, and vapors. Do not obstruct the ventilation openings on the side of the cabinet. This is to make sure that the LA120-RA has proper ventilation and cooling.

Maintain a minimum 4-inch clearance between units at all times. Provide enough clearance for service of the LA120-RA (Figure 4-1).

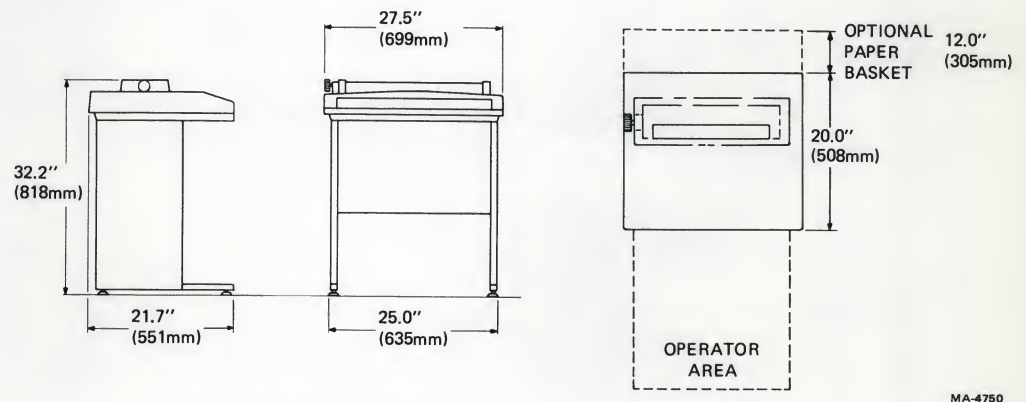
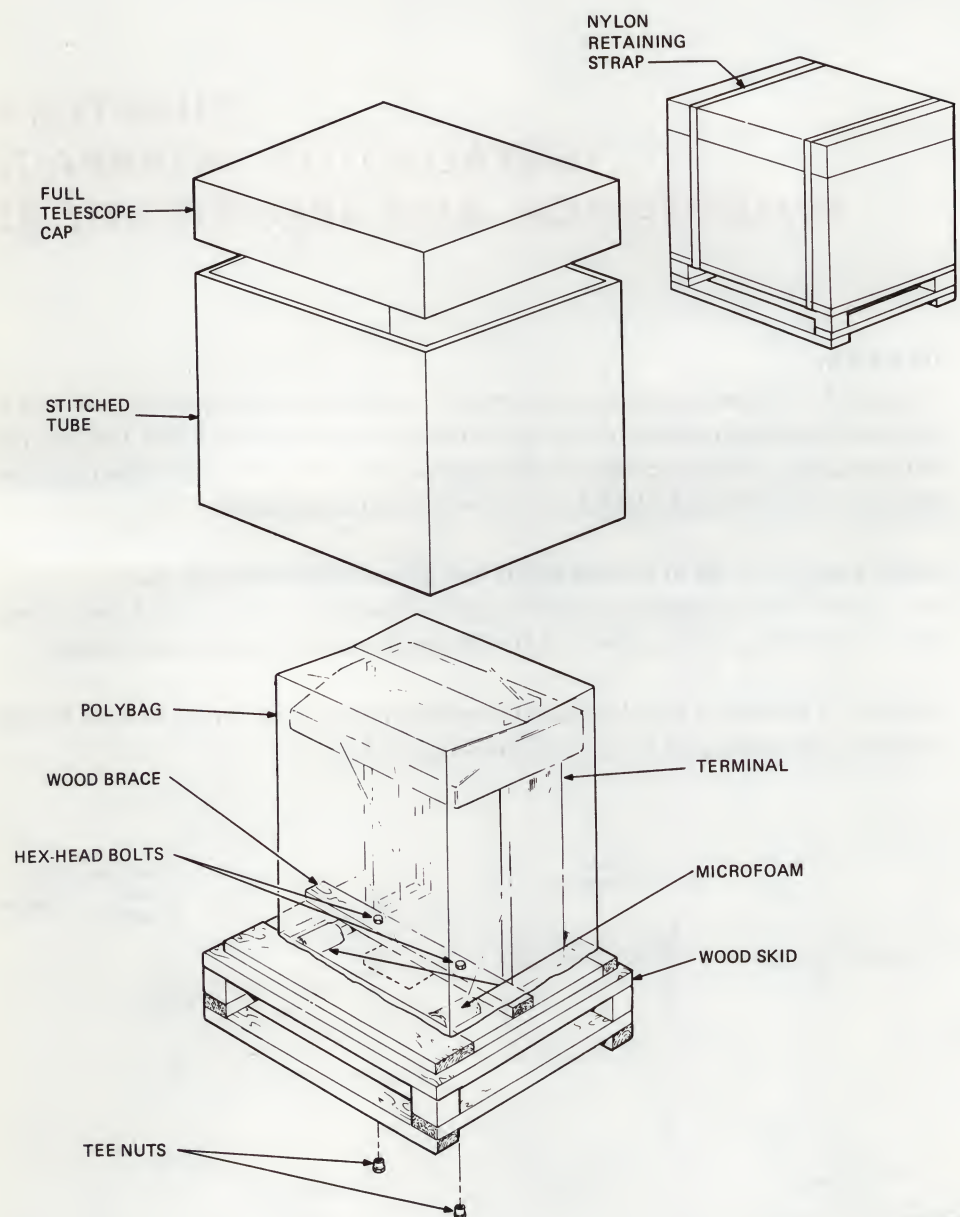


Figure 4-1 LA120-RA Site Considerations



MA-3166

Figure 4-2 Unpacking/Packing

UNPACKING AND INSPECTION

Perform the following procedure to unpack and inspect the LA120-RA (Figure 4-2).

1. Cut the nylon retaining straps from around the shipping carton and discard them.
2. Remove the outer cardboard shipping container.
3. Remove all shock-absorbing material and packing from around the LA120-RA.

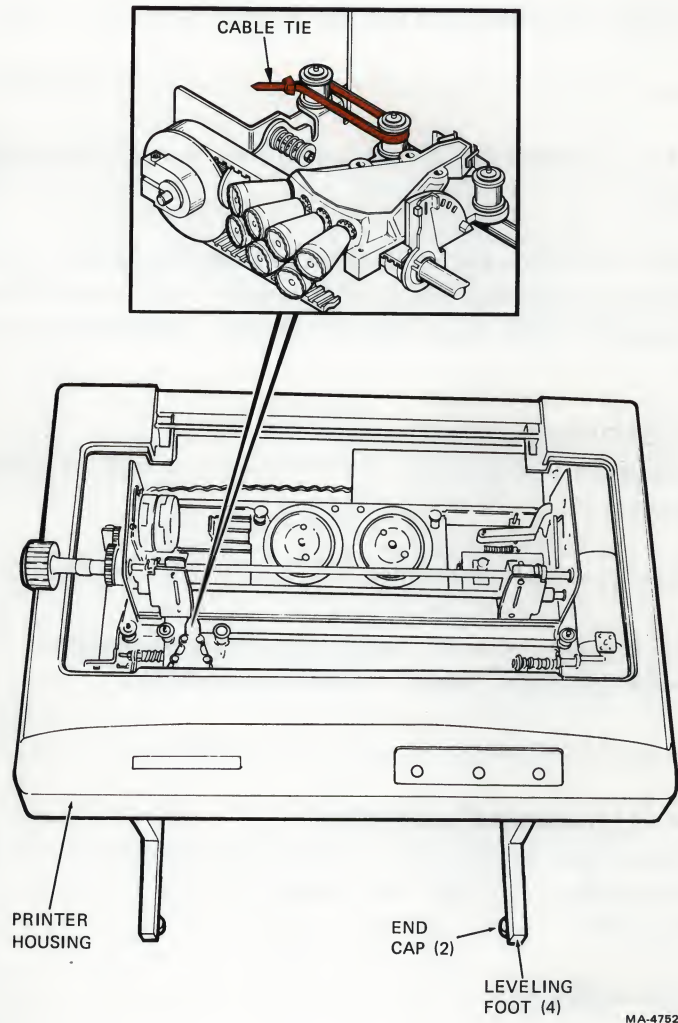


Figure 4-3 Cable Tie Location

4. Loosen and remove the hex-head bolts that secure the wood leg brace to the skid assembly. Remove microfoam from around each leg of the LA120-RA.
5. Carefully inspect the LA120-RA cabinet and carriage assembly for possible shipping damage. Inspect and check the enclosed packing list for lost or missing items. Report damaged or missing items to the local DIGITAL Field Service or Sales Office and the local carrier.
6. Remove the LA120-RA from the wooden shipping skid and place it in a desired location.
7. Lift the LA120-RA top cover assembly. Clip and remove the nylon cable tie securing the printhead assembly (Figure 4-3).
8. Install and adjust the leveling feet on the LA120-RA legs (Figure 4-3).

9. If necessary, wipe the outer surfaces with a clean, soft, lint-free cloth.
10. Connect the EIA interface cable to the operator's equipment.

NOTE 1: To install the 20 mA option refer to the Option Information chapter.

NOTE 2: Site plans are not supplied by Digital Equipment Corporation. Interface logic connections must be specified and provided by the system supplier or the customer because each installation may be different.

PACKING PROCEDURES

If it becomes necessary to ship the LA120-RA to another location, repack it per the following procedure.

1. Remove the ribbon and paper.
2. Using a nylon cable tie, secure the printhead assembly to prevent movement while in transit as shown in Figure 4-3.
3. Pack the LA120-RA as shown in Figure 4-2.

LOCAL FORM FEED ENABLE JUMPER

Jumper W1 (Figure 4-4) on the set-up control panel can be cut to allow the operator to perform the local form feed function without first pressing the ON LINE/OFF LINE button.

POWER ON PROCEDURES

1. Install a ribbon per the ribbon installation procedure. (See the Operating Information chapter for ribbon installation procedures.)
2. Install paper per the initial loading paper/forms procedure. (See the Operating Information chapter for a procedure to load paper forms.)

CAUTION: Before connecting the LA120-RA to a power source, make sure that the line voltage and frequency are compatible with the power requirements of the printer (Figure 1-1). Make sure that the power switch is off.

3. Connect the LA120-RA line cord to a three-prong, non-switched grounded outlet. Set the power ON/OFF switch to on (Figure 1-2). The printhead automatically positions itself to the left margin.
4. Perform the self test procedure. Press and hold the ON LINE/OFF LINE button and press and release the SELF-TEST button to begin self test. The ON LINE/OFF LINE button may now be released. Press the SELF-TEST button again to stop self test.

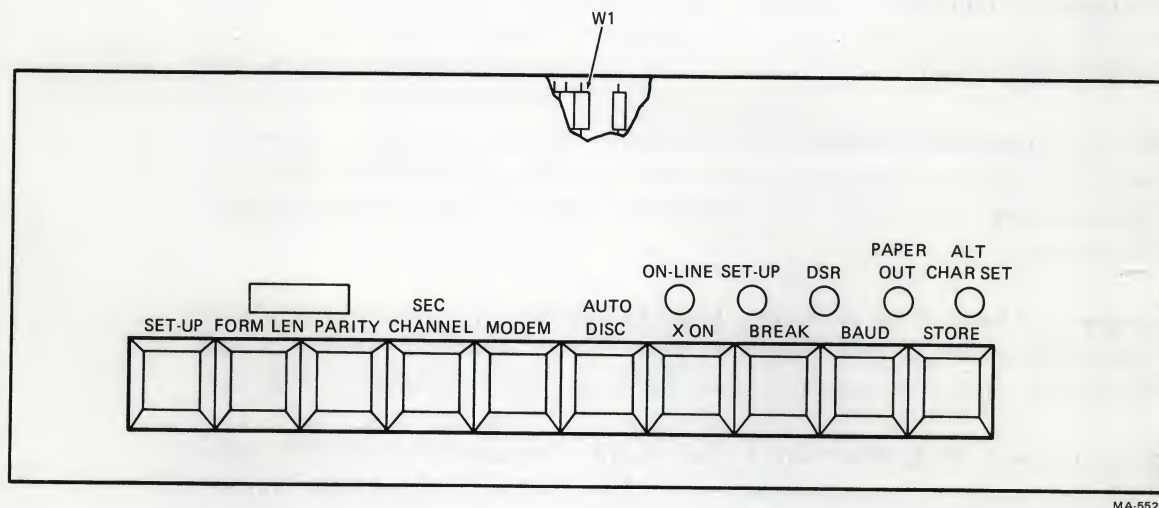


Figure 4-4 Local Form Feed Jumper (W1)

INTERFACE INFORMATION

EIA Interface

The LA120-RA interfaces with EIA devices using an optional BC22 B-10 or BC22 B-25 (10 ft and 25 ft) modem cables with a 25-pin connector. The LA120-RA interface is compatible with the Vadic 3400, Bell 103, 212A, and 202 modems, and meets the requirements of EIA specification RS-232-C. The following paragraphs describe the interface signals. (Connect the LA120-RA interface cable as shown in Figure 4-5.)

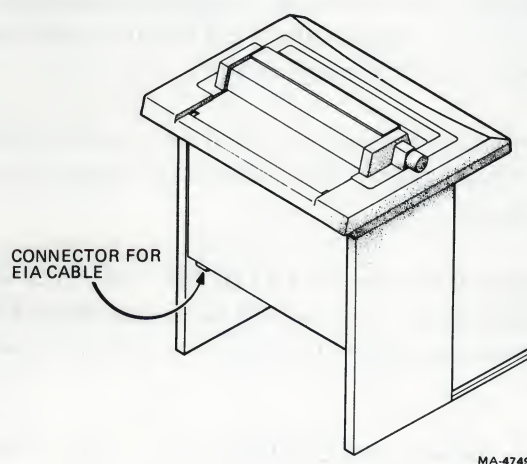


Figure 4-5 Connector for EIA Cable

Protective Ground – This conductor is connected to the chassis of the LA120-RA. It is further connected to external grounds through the third wire of the power cord.

Transmitted Data (TXD) Direction: From LA120-RA – Signals on this circuit represent serially encoded characters generated by the LA120-RA. The LA120-RA does not transmit data on this circuit unless a transmit enable condition exists.

Received Data (RXD) Direction: To LA120-RA – Signals on this circuit represent serially encoded characters generated by the operator's equipment. The LA120-RA does not accept data on this circuit unless the receive line signal detector (RLSD) circuit is on.

Request To Send (RTS) Direction: From LA120-RA – The on condition of RTS means that the LA120-RA intends to transmit data. After this circuit is on, the LA120-RA waits for a transmit enabled condition before starting transmission.

Clear To Send (CTS) Direction: To LA120-RA – Although the LA120-RA physically receives the CTS signal, it is not used for a specific purpose. Depending on the modem protocol in use, data set ready (DSR), carrier detect [receive line signal detector (RLSD)], secondary carrier detect [secondary receive line signal detector (SRLSD)] or a 300 ms timeout after asserting request to send (RTS) is used to create the transmit enable condition as follows.

Modem = 1 on-line

Modem = 2 on-line, DSR = on, RLSD = on for more than 300 ms

Modem = 3 on-line, DSR = on, RLSD = on for more than 300 ms

Modem = (4 or 5) SEC CHAN = off, on-line, DSR = on, RTS = on for more than 300 ms

Modem = (4 or 5) SEC CHAN = on, on-line, DSR = on, RLSD = on for more than 300 ms

Data Set Ready (DSR) Direction: To LA120-RA – The on condition DSR indicates that the operator's equipment is capable of transmitting and receiving data signals. The off condition of DSR causes the LA120-RA to ignore all other interface inputs except ring indicator (RI). In full-duplex without EIA control modem set to 1, this circuit is assumed to always be in the on condition.

Signal Ground – This circuit establishes the common ground reference potential for all interface circuits except protective ground. This circuit is permanently connected to the protective ground circuit.

Receive Line Signal Detector (RLSD) Direction: To LA120-RA – The on condition of RLSD indicates that data transmission to the LA120-RA is enabled. In full-duplex without EIA control, this circuit is assumed to always be in the on condition.

Speed Indicator [Data Signal Rate Selector (SPDI)] Direction: To LA120-RA (Full-Duplex Only) – The on condition of SPDI indicates that the baud rate is 1200 baud, regardless of the rate selected by the operator. The off condition of SPDI indicates that the operator selected baud rate is being used.

Secondary Carrier Detect [Secondary Receive Line Signal Detector (SRLSD)]

Direction: To LA120-RA (Half-Duplex Only) – The on condition of SRLSD indicates that the operator's equipment is capable of successfully processing the transmitted data from the LA120-RA.

Secondary Request To Send (SRTS) Direction: From LA120-RA (Half-Duplex Only)

– The on condition of SRTS indicates that the LA120-RA is capable of successfully processing received data. In restraint mode, the off condition of SRTS indicates that the operator's equipment should temporarily suspend the transmission of data. When SRTS goes on, transmission may be resumed.

Data Terminal Ready (DTR) Direction: From LA120-RA

– The on condition of DTR indicates that the LA120-RA is capable of transmitting and receiving data signals. The off condition of DTR may cause the operator's equipment to set the data set ready signal (DSR) to the off condition. The LA120-RA ignores all interface inputs except ring indicator (RI) when DTR is off.

Ring Indicator (RI) Direction: To LA120-RA

– If data terminal ready (DTR) is off then RI is ignored. If DTR is on, the on condition of RI causes a 20 second timeout at which time the LA120-RA will attempt to establish a connection. If a connection, data set ready (DSR) and carrier detect [receive line signal detector (RLSD)] is not established within 20 seconds then a disconnect sequence (DTR dropped for 70 ms) is started.

Speed Select (SPDS) Direction: From LA120-RA (Full-Duplex Only)

– If the operator selected baud rate is 1200 or higher, then the LA120-RA asserts an on condition on SPDS, otherwise the LA120-RA holds this circuit in the off condition.

Depending on the modem or acoustic coupler in use, these pins may be electrically disconnected from the LA120-RA by cutting the following jumpers on the logic board as shown in Figure 4-6.

Jumper	RS232C	Pin
W9	SPDS	23
W10	SRTS	11
W11	SRTS	19

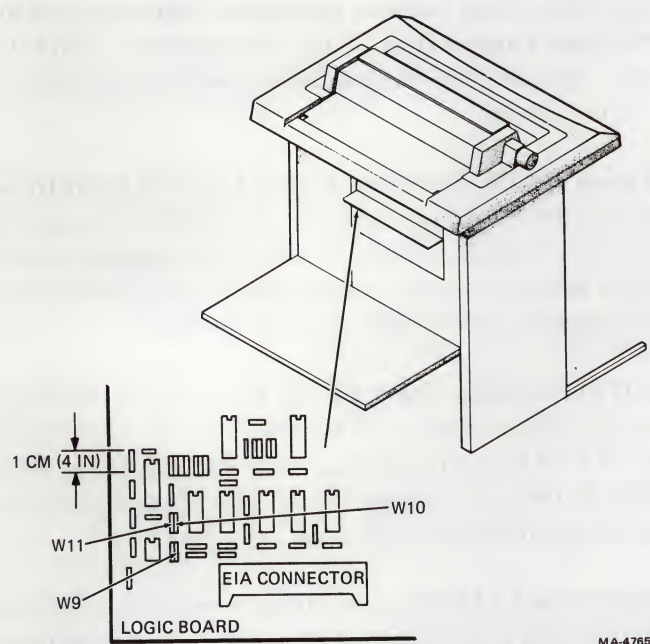


Figure 4-6 Jumper Configuration

Table 4-1 summarizes the EIA interface signals on the LA120-RA.

Impedance of Terminator

The terminating impedance of the receiving end of the interface circuits has a dc resistance of not less than 3000 ohms nor more than 7000 ohms. When the interface plug is disconnected, the interface voltage on the terminator circuits is -2 volts to $+2$ volts.

Rise and Fall Times

The circuitry that receives signals from an interface circuit is dependent only on the signal voltage and conforms to RS-232-C with regard to the rise time and fall time. For control interface circuits, the time required for the signal to pass through the transition region (-3 volts to $+3$ volts) during a change in state does not exceed one millisecond. For the transmitted data circuit the rise time and the fall time does not exceed 16.7 microseconds through the 6-volt range (-3 volts to $+3$ volts). The received data and the clock signals also meet this limit.

Open Circuit Voltages

The open circuit driver voltage with respect to signal ground on any interface circuit does not exceed -12 volts to $+12$ volts. The terminator on an interface circuit is designed to withstand any input signal within the -25 volts to $+25$ volts limit. When the terminating impedance is in the proper range (3000 ohms to 7000 ohms) and the terminator open circuit voltage is zero, the potential at the point of interface is not less than -5 volts to $+5$ volts, or more than -12 volts to $+12$ volts. An open circuit or applied voltage more negative than $+0.6$ volts will be interpreted the same as a legitimate negative applied voltage (-3 to -25 volts.)

Table 4-1 Summary of LA120-RA EIA Interface Signals

Pin	Source	Name	Function	Circuit CCITT/EIA
1	—	—	Protective ground	101/AA
2	LA120	TXD	Transmitted data	103/BA
3	User	RXD	Received data	104/BB
4	LA120	RTS	Request to send	105/CA
5	User	CTS	Clear to send	106/CB
6	User	DSR	Data set ready	107/CC
7	—	—	Signal ground	102/AB
8	User	RLSD	(Receive line signal detector) carrier detect	109/CF
9	—	—	—	—
10	—	—	—	—
11	LA120	SRTS	Unassigned (see pins 19 and 23)	12
12	User	SPDI	Speed indicator (FDX)	CI
12	User	SRLSD	(Secondary receive line signal detector) secondary carrier detect (HDX)	122/SCF
13	—	—	—	—
14	—	—	—	—
15	—	—	—	—
16	—	—	—	—
17	—	—	—	—
18	—	—	—	—
19	LA120	SRTS	Secondary request to send	120/SCA
20	LA120	DRT	Data terminal ready	108.2/CD
21	—	—	—	—
22	User	RI	Ring indicator	125/CE
23	LA120	SPDS	(Data signal rate selector) speed select (FDX)	CH
24	—	—	—	—
25	—	—	—	—

NOTE: Pins 11, 19, and 23 are driven by a common circuit whose function is determined by the modem and secondary channel SET-UP features.

LA120-RA SPECIFICATIONS

Speed	180 characters per second
Baud Rate	Up to 9600 baud
Line Length	13.2 inches maximum
Characters	96 upper/lowercase ASCII 7 X 7 dot matrix
Paper	Tractor drive, pin-feed
Width	7.6 to 37.8 cm (3 to 14-7/8 in)
Weight	
Single-Part	6.8 kg (15 lb) paper minimum 0.25 mm (0.010 in) thick card stock maximum
Multipart	1 to 6 parts (see notes) 0.50 mm (0.020 in) thick maximum

NOTE 1: *Multipart forms may have only one card part. The card must be the last part.*

NOTE 2: *NCR or 3M paper, up to 6-part, must use ribbon on the top copy. First-surface impact paper is not recommended unless ribbon is used.*

NOTE 3: *Continuous-feed, fan-fold business forms with 3- or 4-prong margin crimps on both margins (multipart) are recommended. Stapled forms are not recommended and may damage tractors and other areas of the machine. Dot or line glue margins are acceptable (if line is on one margin only). Do not line glue both margins as air will not be able to escape and poor impressions will result.*

NOTE 4: *Split forms (forms with each side containing a different number of sheets) are not recommended.*

Ribbon	DIGITAL-specified nylon fabric (Part No. 36-12153-01)
Spool Assembly	12.7 mm wide X 54.87 m long (0.5 in X 60 yd)
Power Input	90-128 Vac or 180-256 switch selectable 49-61 Hz
Consumption	4.2 A @ 115 Vac (440 W)

Temperature

Operating	10° to 40° C (50° to 104° F), noncondensing
Nonoperating	-40° to 66° C (-40° to 151° F), noncondensing

Relative Humidity

Operating	10 to 90 percent with a maximum wet bulb temperature of 28° C (82° F) and a minimum dew point of 2° C (36° F), noncondensing
Nonoperating	5 to 95 percent

Dimensions

Width	69.85 cm (27.5 in)
Height	817.88 cm (32.2 in)
Depth	750.8 cm (20 in) deep

Shipping Weight

54.5 kg (115 lb)

CHAPTER 5

OPTION INFORMATION

GENERAL

The LA120-RA has options available that enhance the basic terminal and allow its use in a wide range of applications. The options currently available are:

20 mA current loop option (Part No. LA12X-AL),

Expanded buffer option (Part No. LA12X-DL),

Five European national character sets and an APL character set (Part No. LA12X-TL).

The following paragraphs describe the options currently available and the procedure to install each option.

20 mA CURRENT LOOP OPTION (PART NO. LA12X-AL)

The 20 mA loop option allows the terminal to communicate directly with the host computer up to a distance of 305 m (1000 ft) without the use of a modem.

To install the 20 mA option refer to Figure 5-1 and perform the following steps.

1. Set the TRANS switch on the 20 mA assembly to the NORMAL (passive) position. (If the LA120-RA must provide current to the transmit line, set the switch to the ACT position.)
2. Set the REC switch to the NORMAL (passive) position. (If the LA120-RA must provide current on the receive line set the switch to the ACT position.)
3. Loosen two 8-32 screws and lift out the rear cabinet door on the LA120-RA.
4. Disconnect and remove any previously connected plug from J8 on the logic board.
5. Slip the 20 mA logic board assembly up through the hole in the floor of the cabinet. Secure with two (8-32) hex-head screws and #8 lock washers.

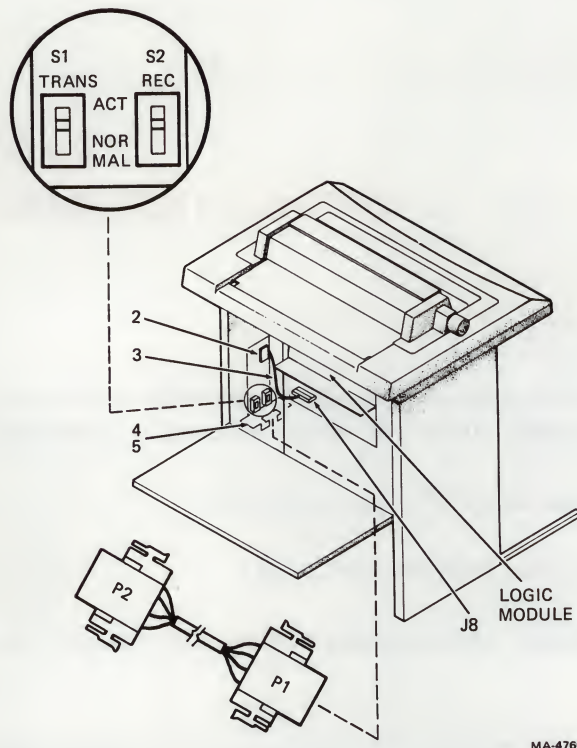


Figure 5-1 20 mA Loop Option Installation

6. Connect the 20 mA harness assembly between the jack on the 20 mA logic board and J8 on the logic board observing the "this side up" label on assembly.
7. Place the LA120-RA in SET-UP mode. Select and store the following SET-UP features.

Modem SET-UP feature set to 1 (FDX, no modem)

Auto disconnect SET-UP feature set to 0 (off)

8. Connect P1 of the 20 mA external interface cable to the bottom connector on the 20 mA logic board.

Test After Installation

After the LA120-RA is connected to a communication system, send the LA120-RA the ANSI Product Identification escape sequence. (See the Programming Information chapter for the ANSI Product Identification escape sequence to verify installation.)

Table 5-1 is a description of the electrical characteristics of the LA120-RA.

Table 5-1 Electrical Characteristics

Transmitter	Min	Max	Receiver	Min	Max
Open circuit voltage	5.0 V	50 V	Voltage drop marking	—	2.5 V
Voltage drop marking	—	4.0 V	Spacing current	—	3.0 mA
Spacing current	—	2.0 mA	Marking current	15 mA	50 mA
Marking current	20 mA	50 mA			

EXPANDED BUFFER (PART NO. LA12X-DL)

Typically a printer receives a series of characters, temporarily stores the characters in a buffer, and then prints the characters one at a time. The LA120-RA contains a standard 1000 character buffer. This option enables the standard 1000 character buffer to be increased in size to 4000 characters (4K).

An example of the use of this option is an LA120-RA connected to a video terminal whose screen contains 24 lines at 132 characters per line (total of 3168 characters). The LA120-RA could receive these characters at 9600 baud, store all 24 lines in the buffer, and then print the characters at the printing speed of the LA120-RA (180 characters per second).

If XON/XOFF is selected, XOFF will still be generated when the input buffer reaches 576 characters. The only difference is that the buffer is now 4000 characters instead of 1000 characters.

If XON/XOFF, or the equivalent is not used, and the system is operating at high baud rates (for example 2400 baud) for long periods, it may be possible to exceed the 4K buffer capacity.

Perform the following procedure to install the LA12X-DL expanded buffer option.

1. Set the power ON/OFF switch to OFF and disconnect the ac line cord.
2. Loosen two (8-32) screws and lift out the access door from the rear of the cabinet.
3. Attach the expanded buffer option module standoffs to the expanded buffer module (Figure 5-3).

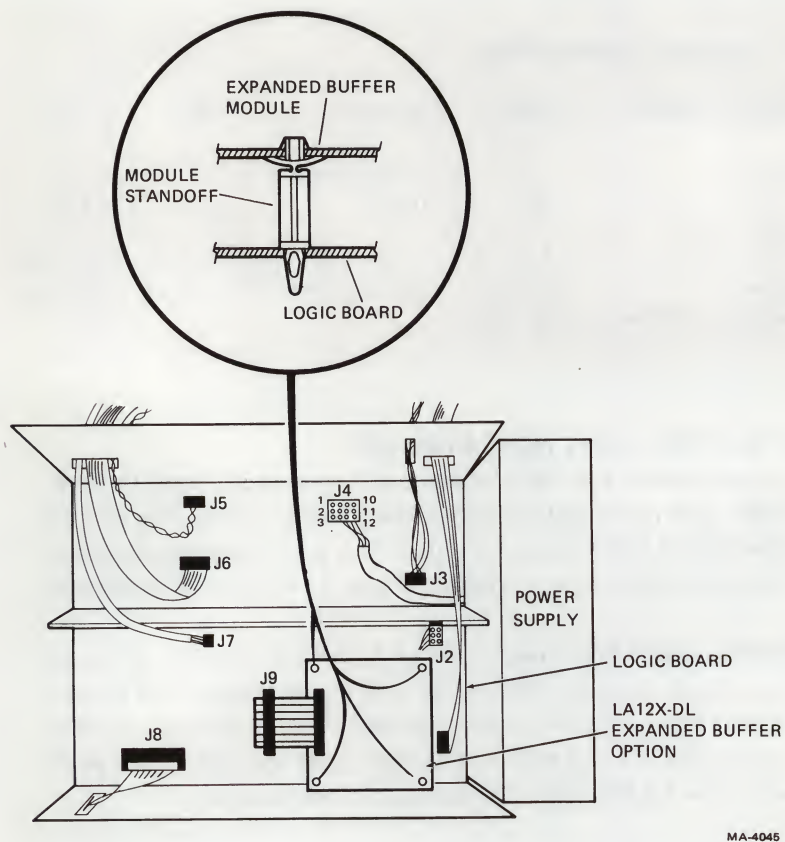


Figure 5-2 Expanded Buffer Option Installation

4. Secure the LA12X-DL option module to the logic board (Figure 5-2).
5. Connect the expanded buffer option connector to J9 on the logic board. Make sure that the connector is properly seated.
6. Install the rear access door.

EUROPEAN NATIONAL CHARACTER SETS (LA12X-TL)

Five European national character sets and an APL character set are available as an option. The European national character sets are selected by the programmer using the printable character set escape sequence. (See Programming Information chapter for printable character set escape sequence.) The European national character sets differ from United States ASCII in only a limited number of code positions.

The code differences among the national character sets are shown below in Table 5-2.

Table 5-2 National and APL Character Sets

Character Set	Code											
	043	100	133	134	135	136	140	173	174	175	176	
United States	#	@	[\]	^	_	{		}	~	
Great Britain	£	@	[\]	^	_	{		}	~	
Finland	#	@	Ä	Ö	Å	U	é	ë	ö	ä	ü	
Sweden	#	£	Ä	Ö	Å	U	é	ë	ö	ä	ü	
Norway/Denmark	#	Ä	Æ	Ø	Å	U	ë	æ	ø	ä	ü	
Germany	#	£	Ä	Ö	U	^	_	ä	ö	ü	ß	
France	£	à	°	ç	§	^	_	é	ù	è	''	

The following additional escape sequences select the optional printer character sets.

ESC (C Finland
 ESC (E Norway/Denmark
 ESC (H Sweden
 ESC (K Germany
 ESC (R France

NOTE: The space character (octal code 040) never appears in an escape sequence. Characters are spaced apart for clarity only.

APL CHARACTER SET (LA12X-TL)

The optional APL character set can be selected by the SO control character, independent of the national character set in use. The SI control character returns the printer to the previously selected national character set.

The following procedures describe the steps necessary to install the option ROM to use the European National Character Set Option and the APL Character Set Option.

1. Set the power ON/OFF switch to OFF (Figure 1-2); disconnect ac line plug from wall receptacle.
2. Loosen two (8-32) screws and lift out the access door from the rear of the cabinet.
3. Remove standard ROM chip from logic board at location E4 (Figure 5-3) as follows: alternately insert tip of small, flat-blade screwdriver (or corner of keycap puller) between chip and receptacle at top and bottom ends. Turn tool slightly at each end until pins are free. Do *not* use rocking motion while removing chip.

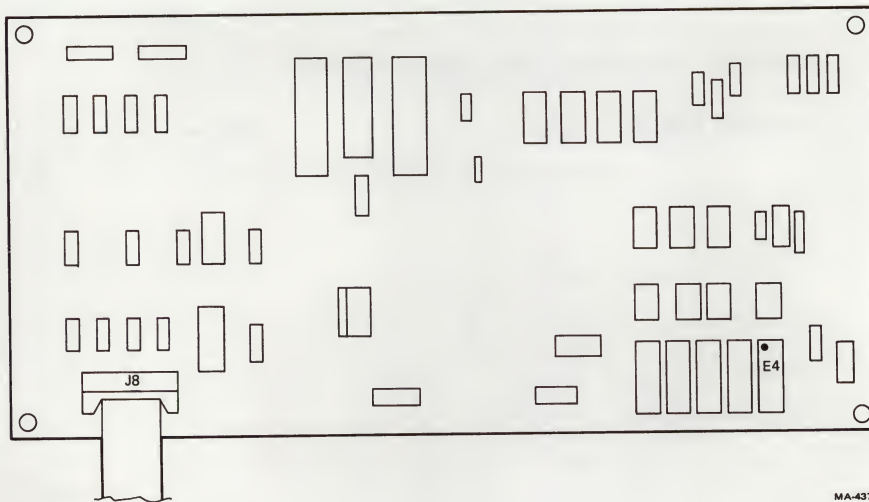


Figure 5-3 Option ROM Chip Installation

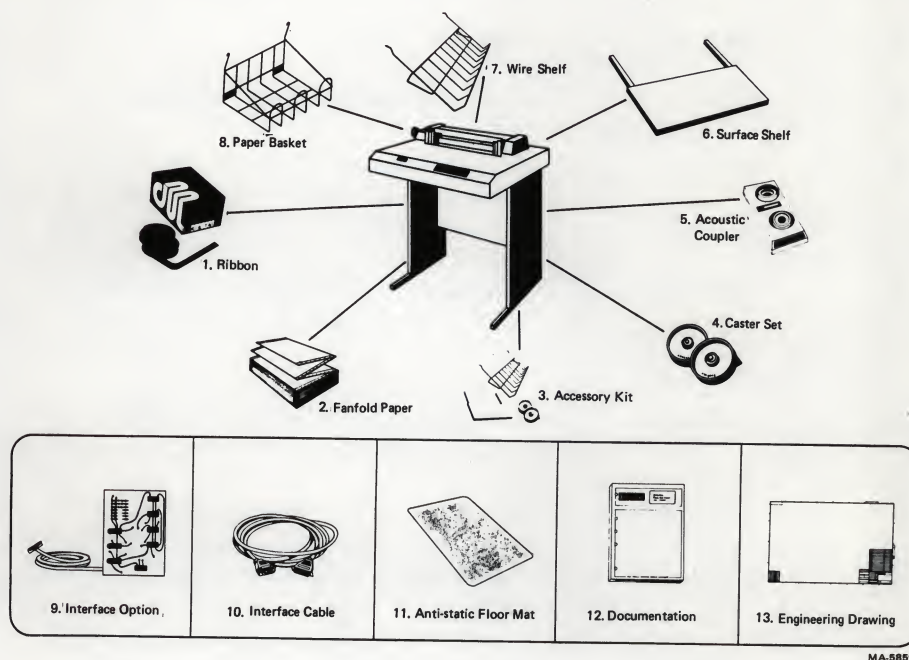
4. Carefully remove option ROM chip from conductive carrier. Mount standard chip in its place for storage.
5. Install the option ROM chip at location E4 of logic board so that pin 1 (identified by small dot) is located in upper-left corner and carefully engage all pins in connector sockets.
6. Gently press chip straight in until fully seated. Do *not* use rocking motion while inserting chip.
7. Install the rear access door.

NOTE: Verification of the European national character set and the APL character set installation must be done from the remote device.

CHAPTER 6 ACCESSORIES AND SUPPLIES

GENERAL

The LA120 series terminals offer improved quality printing and forms-handling versatility. A wide variety of accessories and supplies are available to enhance printer reliability and make operation easier. The following paragraphs describe the LA120 RA accessories and supplies.



SUPPLIES

Item No.	DEC Part No.	Description
1	36-12153-01	Ribbon, nylon, 0.5 inches wide x 60 yd long (1.27 cm x 54.9 m) 12/box
1	LAXXR-N0	Nylon ribbons, lot of 100 dozen
2	36-09141-00	Fanfold paper, white, with green bars, 132-column, 14-7/8 inches wide x 11 inches high (37.8 cm x 27.9 cm), 2400 sheets/box

SUPPLIES (Cont)

Item No.	DEC Part No.	Description
2	36-05361	Fanfold paper, white, gray-lined, 72-column, 8-1/2 inches wide x 11 inches high (21.6 cm x 27.9 cm), 3200 sheets/box.
2	36-09829	Fanfold paper, white, gray-lined, 80-column, 9-7/8 inches wide x 11 inches high (25.1 cm x 27.9 cm), 3200 sheets/box

ACCESSORIES

Item No.	DEC Part No.	Description
3	LAXX-KA	Accessory kit, includes one LAXX-KB, one LAXX-KC, and one LAXX-KD
4	LAXX-KB	Caster set, 2 pieces
5	DF01-A	Acoustic telephone coupler, 300 baud
6	LAXX-KC	Work surface shelf, 24 inches long x 15 inches wide x 2 inches high (60.9 cm x 38.1 cm x 5.1 cm)
7	LAXX-KD	Wire shelf, 10-1/2 inches L x 18 inches W x 2 inches H (26.7 cm x 45.7 cm x 5.1 cm)
8	LAXX-NC	Paper basket, 12 inches L x 16 inches W x 13 inches H
9	LA12X-AL	20 mA current loop interface option
10	BC03M-AO	Female-female null modem cable 100 ft (30.5 m)
10	BC03M-B5	Female-female null modem cable 250 ft (76.2 m)
10	BC03M-EO	Female-female null modem cable 500 ft (152.4 m)
10	BC03M-LO	Female-female null modem cable 1000 ft (304.8 m)
10	BC05X-15	20 mA current loop extension cable 15 ft (4.6 m)
10	BC05X-25	20 mA current loop extension cable 25 ft (7.6 m)

ACCESSORIES (Cont)

Item No.	DEC Part No.	Description
10	BC05X-50	20 mA current loop extension cable 50 ft (15.2 m)
10	BC22A-10	EIA RS232 female-female null modem cable shielded 10 ft (3.0 m)
10	BC22A-25	EIA RS232 female-female null modem cable shielded 25 ft (7.6 m)
10	BC22B-10	EIA RS232 male-female extension cable shielded 10 ft (3.0 m)
10	BC22B-25	EIA RS232 male-female extension cable shielded 25 ft (7.6 m)
10	BC23A-10	Kit of 5 BC22A-10
10	BC23A-25	Kit of 5 BC22A-25
10	BC23B-10	Kit of 5 BC22B-10
10	BC23B-25	Kit of 5 BC22B-25
11	H9850-DA	Antistatic floor mat, DECmat, 4 ft x 6 ft (1.22 m x 1.83 m), Driftwood color (brownish gray)
11	H9850-DB	Antistatic floor mat, DECmat, 4 ft x 6 ft (1.22 m x 1.83 m), Summer Earth color (brown/gold)
11	H9850-DC	Antistatic floor mat, DECmat, 3 ft x 10 ft (0.91 m x 3.05 m), Silver Birch color (silvergray/brown)
11	H9850-DD	Antistatic floor mat, DECmat, 3 ft x 10 ft (0.91 m x 3.05 m), Autumn Bronze color (orange/brown)
11	H9850-DE	Antistatic floor mat, DECmat, 3 ft x 10 ft (0.91 m x 3.05 m), Driftwood color (brownish gray)
11	H9850-DF	Antistatic floor mat, DECmat, 4 ft x 6 ft (1.22 m x 1.83 m), Silver Birch color (silvergray/brown)
11	H9850-DH	Antistatic floor mat, DECmat, 4 ft x 6 ft (1.22 m x 1.83 m), Autumn Bronze color (orange/brown)

DOCUMENTATION

Item No.	DEC Part No.	Description
12	EK-LA2RA-UG	LA120-RA User Guide
12	EK-LA120-PS	LA120 Series Pocket Service Guide
12	EK-LA120-TM	LA120 Series Technical Manual
12	EK-LA2RA-IP	LA120-RA Illustrated Parts Breakdown
13	MP-01046	LA120-RA Engineering Drawing

SPARES KIT

Item No.	DEC Part No.	Description
—	4A-LA120-RA	LA120-RA spares kit

HOW TO ORDER**Toll Free Telephone Ordering**

Continental US only – 800-258-1710 (in N.H., Hawaii and Alaska dial 603-884-6660) Hours: 8:30 a.m.–5:00 p.m. Eastern Time

Important Information Prior to Ordering Via Telephone

- Minimum order of \$35.00 unless charged to Master Charge, Visa or American Express
- Maximum order of \$5000.00
- Phone orders are accepted at current list price only
- Phone orders are accepted per DIGITAL standard terms and conditions only

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- Purchase Orders should be mailed directly to:

U.S. Customers

Digital Equipment Corporation
ATT: A&SG
P.O. Box CS2008
Nashua, NH 03061

International Customers

Digital Equipment Corporation
A&SG Business Manager
c/o Digital's local subsidiary

Important Information Concerning Direct Mail Orders

- Minimum order value of \$35.00 unless items paid by check, money order or credit card, (Visa, Master Charge or American Express, accepted).
- No maximum order value

LOCAL DIGITAL SALES OFFICES

Purchase Orders may also be submitted to your local DIGITAL Sales Office.

APPENDIX A OTHER TERMINALS

The terminal is the vital link between the use and the power of the computer. The right terminal or the enhancement to your terminal can make your work easier, more efficient, and more cost effective. For that reason, DIGITAL offers a full range of video and teleprinter terminals and options that can help you tackle any application.

VIDEO TERMINAL

For the ultimate in video terminals, look to DIGITAL VT100. It combines exceptional versatility with simplicity of operation. And it's designed to allow a wide range of fast and easy field upgrades to meet your changing needs.

The VT100 has a detached typewriter-style keyboard with a flexible 3-wire coiled cord. An 18-key numeric/function keypad on the keyboard permits single key-stroke control of application-specific functions. The VT100 fits easily on a standard typewriter table. It has an advanced video option that provides 132-column lines on the screen for easy viewing of wide-line printer reports. Double-height/double-width characters are selectable line by line for easier reading and text formatting. Smooth scrolling a scan at a time lets your operators read new lines at a reasonable speed. Divided-screen displays; blinking, underlining, double intensity, and normal or reverse video character attributes; keyboard and/or computer-setting tab stops; built-in self-test diagnostics; and pictorial capability; are some of its many features.

INTELLIGENT VIDEO TERMINAL

At the head of the VT100 class are DIGITAL's intelligent PDT-11 terminals. The PDT family includes three programmable data terminals: the PDT-11/110, the PDT-11/130, and the PDT-11/150. With their PDP-11 compatible processors and RT-11 operating system, the PDTs permit you to draw on a wide range of existing software.

Local mass storage is available on the PDT-11/130 in the form of 524K bytes of storage provided in dual mini cartridges. Housed within the same VT100 shell, these mini cartridges are file-structured system devices. The PDT-11/150 lets you combine the functionality of the PDT-11 with the dual floppy disk storage of any DIGITAL terminal. With its four ports, the PDT-11/150 allows considerable system expansion. Add a terminal controller if you want the flexibility of up to four terminals. For hardcopy, add a printer to the printer port. There's a third port for an EIA link to a host computer.

LA 120 DECPRINTER III

The LA120 DECprinter III offers better throughput than that of terminals with faster print speeds. Like the LA120-RA, the 180 character per second printhead prints bidirectionally and always seeks the next print position. The LA120 offers an unexcelled range of standard features. Over 45 keyboard-selectable features are offered. These features include variable font sizes, tabs, form length, and many other features previously available only as options. To guide the operator through the many possible configurations, the carefully human-engineered terminal uses mnemonic commands, a prompting LED display, a special decal, and a convenient pocket-sized operator card.

LA34/LA38 DECWRITER IV

Everything about the 300 baud desktop terminals adds up to convenience. They are smaller, lighter, and quieter than many typewriters. They have sculptured, typewriter-like keys, and a cartridge for simple ribbon changes. All features are set at the keyboard, including four character width adjustments. They also have automatic self test diagnostics.

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LA120-RA User Guide
EK-LA2RA-UG-001

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